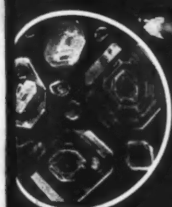
CHEMISTRY



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Highways From a Test Tube

➤AUTOMOBILE TRAVEL has created the hard-surfaced road which has become so universal that the ruts and mudholes of pre-automobile days are almost forgotten in America. But the airplane and the landing barge encounter the old conditions. Very few kinds of natural soil offer good support for heavy mechanical vehicles. Sand and mud alike offer yielding surfaces in which their wheels bog down.

From Roman times onward, roads have been built of rock, sand, cement and tarry materials, at the cost of heavy work with a pick and shovel, in addition to the price of the materials.

Early development in the good roads program was largely in the direction of power tools to multiply the effectiveness of the ditch digger. Today the construction of the modern graded super highway, with banked curves, grade separations, clover-leaf entrances and safety shoulders rolls along at a well-calculated schedule. Where roadmaking equipment and materials are at hand, the problem of producing the road is pretty well solved.

On the frontiers of the world the problem is to create the equivalent of the paved road surface without the heavy equipment, and to do it faster. For that task, engineers are asking chemists to give them new materials. The closer these materials can come to changing the existing soft sands or slippery clay into hard resilient surfaces with the advantages of concrete and asphalt and, preferably, without their faults, the better the engineers will be pleased.

Chemists are used to being asked for miracles. "The impossible takes a little longer." Beginnings have been made on the soil stabilization problem from several angles. None are perfected, but there are promising leads for anyone wishing to tackle the problem.

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➤ Synthetic gravel *as it might be used for a pavement foundation is studied in the laboratory by Prof. Julian C. Smith (left) and Professor Benjamin K. Hough of Cornell University. The research workers developed the process for making the material from mud and inexpensive chemicals.*

Soils Solidified by Chemicals

by A. C. Monahan

➤ Chemical treatment is replacing mechanical operations both in solidifying soil as a foundation for highway and airport runway paving and in making garden and farm soils loose and workable for the benefit of crops grown on it.

This does not mean that the many types of rollers now used to compact soil are destined for the junk heap. They will still be needed for the final step in the chemical treatment. Also they will continue to do the job alone where a high degree of compactness is not required and where the chemical process is too costly for the particular job.

The use of chemicals to change the physical conditions of soil is not al-

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together new but much progress in their use has developed since World War II. The research responsible is one of the direct results of experiences in the war. The military angle is concerned with solidifying beach sands so that motorized military equipment can cross inland in amphibious landings, and in preparing temporary landing strips for aircraft in combat areas.

Soil Stabilization

Soil stabilization is the term used for the process of treating beach sands, chemically or physically, so that heavy vehicles can cross them with comparative ease. The same term is used for the treatment of soils for aircraft runways. It applies likewise to subsoil treatment for highways and airports, and to processes of treating sloping banks along highways to prevent their erosion.

Modern soil stabilization has gone a step further. It is concerned with the treatment of agricultural lands to make them more easily worked by farm tools and machinery and better suited for plant growth. It is concerned with treatment to prevent the erosion that now is costing America millions of dollars each year in the loss of the top soil that makes effective crop-growing possible.

Much of America's farm lands are clay soils that have a tendency to be dense and sticky when wet and a hardpan when dry. Much soil is also sandy and subject to water and wind erosion. Soil stabilization is an attempt to find practical chemical methods that will make the farm soils more workable, suitable for plant growth and less subject to erosion.

Man has been interested in improving the natural condition of the soil ever since the early days of agriculture. Most of the work, however, was confined to improving its fertility and ability to produce crops. Now there is a new attitude toward the soil. At the same time, the automobile and the airplane have forced attention to stabilizing soil for highway and airport construction.

Modern war, in which beach-head landings of invasion forces are employed, has directed attention to beach sand stabilization. Military organizations, road engineers, airport officials and agriculturists are all attacking the soil stabilization problem from their own standpoint but the work is coordinated and progress by one group benefits the other.

In these days of wars and threats of war all circumstances encountered in beach-head landings are important. Particularly important is the necessity of getting modern war machines ashore to equip and support the fighting men. The wide strips of loose sands on the beaches constitute a problem that must be conquered. In this the military forces, both Army and Navy, are making progress.

The Navy's great interest in this is due to the fact the Marines are often the first fighters to make an amphibious landing. But both branches of the armed services are working together on the problem of beach sand stabilization and the Air Force has an interest because the same or a similar process will find application in the preparation of combat-area aircraft strips.

What seems at the present time to be the preferred treatment of beach sands to provide hardened strips from water edge to solid earth is with a

▸ CHEMICALLY-STABILIZED SOIL *is tested for compaction with a vibratory tamper, as shown at the Indianapolis experiment station of the Civil Aeronautics Administration. Airport runway pavings require a firm foundation for the heavy planes now in use.*

chemical known as aniline-furfural resin. The use of this preparation seems successful. Its application presents some difficulties because it must be thoroughly mixed with several inches of the top sand to form a weight-bearing surface.

The mixing is a machine job. The mixer, developed for the purpose, is drawn by a caterpillar tractor. It picks up the sand to a certain depth, mixes it with the chemical preparation and spreads it back in the space from which it came. Compacting with roll-

ers follows. Two hours after construction the strip will support a jeep and after eight hours will support a loaded truck whose weight is close to 20 tons.

Early tests of aniline-furfural treatment and equipment for its application were carried out on a California beach in 1948. Evaluation tests were made later in the East by both Navy and Army. The mixer was brought to Fort Belvoir, Va., to the Research and Development Laboratory of the Army Corps of Engineers. There it was successfully used to apply the aniline-furfural treatment to low-bearing-value clay.

Much work remains to be done on the perfection of the aniline-furfural process. Equipment more suitable for use in amphibious landings is needed. Catalysts to control the setting time of the resins used are desirable and are under study. The equipment must be fast in action and easily handled. The setting process must also be fast, and it must be sure under the various conditions to be encountered.

Synthetic Gravel

In another soil stabilization process, recently announced by Cornell University, a synthetic gravel is made from mud with the help of the "headache" waste sulfite liquor discharged from paper pulp mills to which either sodium or potassium bichromate is added. The process is particularly suitable for use in the great areas of the United States where natural gravel is not available for road and airport construction.

This paper-making byproduct, sulfite liquor, of which some 3,000,000 tons goes to waste each year, has long been used in limited quantities for dust-laying and temporary stabilization of muddy roads. Treatments with it are not lasting because the sulfite liquor is soluble in water.

When the chromium compound is added to it, however, a stiff, water-insoluble jelly is formed. When the jelly is mixed with mud and run through a briquetting machine, solid briquettes are made which have good cohesive strength and are little affected by water. The briquettes can be used as they come from the machine, or they can be broken in a stone crusher.

This stabilization method was developed by Benjamin K. Hough and Julian C. Smith of the Cornell staff and will be known as the Chrome-Lignin process. A truckload of chemicals can produce some 30 truckloads of gravel. The chemical mixture can be mixed with sand on a beach to penetrate to a depth of several inches. It hardens the sand into a stiff, rubbery surface.

The sulfite-chrome binder is found to be effective with a wide variety of soils, ranging from beach sands to heavy clays, and it is not affected by organic matter in the soil. Briquetting machines can be truck-mounted so that the dog-biscuit size lumps can be made in the field on the job. Costs are roughly competitive with stabilization of soil with cement or asphalt.

One of the earliest materials used to stabilize soil, particularly in country roads and the subsoil of highways and airfields, is portland cement. When used in this manner the product is called soil-cement. It is a tightly compacted mixture of soil, cement and water which solidifies upon setting.

The soil-cement process generally utilizes the soil on the site or nearby granular material. Before application, the material must be tested to determine the amount of cement and water required. When the soil is brought to the proper grade, the cement is spread on it and worked in with a farm disk harrow.

Then the proper amount of water is applied and the mixing continued. Following this the soil-cement is compacted with rollers. For country roads the soil-cement construction is often covered with a bituminous surface. Millions of square yards of soil-cement paving are already in use in the United States in roads, airports, parking lots and other places.

Important in experimental and development work in solidifying soil under airport runways are activities of the U. S. Civil Aeronautics Administration. The results are of value to road engineers as well as to airport construction authorities. The stabilization methods studied were largely chemical or physico-chemical. Such materials were employed as portland cement, bitumens, and limes, and included common products such as hydrated lime, sodium silicate, slag and calcium chloride.

Four stabilizing products were found most satisfactory as a result of the study. They are portland cement with an admixture of certain resins, aniline-furfural resin plus certain additives, resorcinol-formaldehyde resin plus a hardener, and phenol-formaldehyde resin plus a hardener, and phenol-formaldehyde resin containing a catalyst.

Bituminous materials were not effective when used alone with any of the soils tested. Certain of them, however, were considerably improved by the addition of small quantities of artificial resins, particularly aniline-furfural. Sodium silicate, hydrated lime, powdered slag and calcium chloride were not effective when subjected to laboratory and field tests.

Molasses and Oil

Blackstrap molasses and bunker fuel oil are the principal ingredients of another binder to make beach sands hard enough for the passage of heavy military equipment in future amphibious landings. Asphalt can be used instead of the oil.

The development of this binder, now known as Plasmofalt, is described by George W. Rappleyea of the Tropical Agricultural Research Laboratory, Southport, N. C., where the work was done under contract with the U. S. Marine Corps.

The use of molasses as a stabilizer is not new. In 1910, the U. S. Department of Agriculture constructed an experimental road in Newton, Mass., using molasses as a binder. The road was a failure because the molasses, being soluble in water, washed away during the first heavy rain. Experimental work was done in India in 1936-38 in which the binder was a polymerized mixture of blackstrap molasses and asphalt.

Plasmofalt concentrate contains a maximum amount of powdered molasses, catalyst and accelerator in a minimum amount of fuel oil. A 55-gallon drum of this when sent ashore and mixed with 10 barrels of fuel oil from the ship's bunkers produces two tons of Plasmofalt when heated a half

hour at 450 degrees Fahrenheit. These two tons, when mixed with sand, gravel or crushed rock, made 42 tons of paving material, or enough to make a paving of 840 square yards one inch thick.

Stabilizing the soils of agricultural lands is concerned largely with the treatment of clay soils to make them easier to work in both wet and dry conditions and improving the properties of the clay so that vegetation can grow more easily. The long-used method is the addition of vegetable matter. Plowing under green crops, such as rye, clover and soybean, is a widely used method. The addition of composts made from leaves and other farm wastes, or peat moss, are also common practices.

The addition of lime to clay soils has also been found beneficial in improving workability. This is in addition to the value of lime in decreasing the acid condition of some soils. Extensive studies of lime applications have been made recently by the Agricultural and Mechanical College of Texas. These studies were concerned principally with gaining an understanding of the primary changes brought about in plastic clays by the lime so that a more intelligent use of it might result.

These long-used methods of improving the workability of clay soils may soon be replaced, in part at least, by new acrylonitrile chemicals recently developed and marketed first in 1952. That is another story. (See CHEMISTRY, January, 1952, p. 1) largely to be told in the future as to results.

Burn Liquor Wastes From Paper Plants

➤ CALCIUM-BASE SULFITE liquor, a stream-polluting waste product from paper mills, can be burned in a furnace which has been described to the American Society of Mechanical Engineers by H. A. Sorenson of the division of industrial research at Washington State College.

Disposing of sulfite liquor has been a problem to paper mills. The simplest and cheapest way to dispose of it is to dump the waste into nearby streams and rivers. But public opposition and legislation indicated another solution to the problem was needed.

An eight-foot-long, sheet-steel, horizontal cylinder insulated on the inside with firebrick was constructed at the college for experimental burning of sulfite liquor. A conventional-type oil burner was placed in one end of the furnace from which oil was sprayed into the furnace, producing a fire to burn the sulfite liquor. A steam-atomizing oil burner nozzle was used to spray the sulfite liquor into the furnace. Later it was discovered that the liquor would burn without the support of the conventional oil burner.

Efficiency of the furnace was figured to be 76%, but making the fire more turbulent should raise the figure substantially, Mr. Sorenson reported.

Mesons, Radiocarbon, Imminent Atomic Power

News of Subnuclear Science

➤ THE KEY to understanding what forces hold the hearts or nuclei of atoms together, one of the basic problems in atomic physics, lies in the elementary particles known as pi-mesons.

These particles bear the same relation to nuclear forces as the photons, or light particles, bear to the electronic and magnetic forces acting between charged particles, Dr. Bruno Rossi, Massachusetts Institute of Technology professor of physics, suggests in a book just published. (High Energy Particles—Prentice-Hall).

Protons, neutrons and electrons are the constituents of matter. Mesons are particles with masses intermediate between those of the electron and the proton. They are unstable and decay spontaneously in much the same way as radioactive atoms.

Even if we knew all about the elementary particles and the laws governing their behavior, we could not apply them to explain the living cell, Dr. Rossi declares.

Common sense warns us that the properties of complex systems, for example, those that form a living cell, may well be more than the sum of the properties of their ultimate constituents, Dr. Rossi observes. It is nevertheless true that, since all matter is an aggregate of protons, neutrons and electrons, an understanding of the properties of these elementary particles is a prerequisite to the understanding of the properties of matter.

Radiocarbon Dating

➤ OIL IS being formed now in offshore tidelands waters. The idea that nature needs a million years or more to manufacture our vast petroleum resources is an exploded scientific theory as the result of new radiocarbon dating findings reported to the American Chemical Society.

Dr. J. L. Kulp of Columbia University's Lamont Geological Observatory, Palisades, N. Y., told of the success of Dr. Paul Smith of the Esso Laboratories in finding in marine sediments appreciable hydrocarbons accumulating at the present time. This accounts for the way oil has been formed in the past.

The formation of oil at the present time solved one of the prime geological mysteries. It was proved by measurement of the radioactivity of the deposit. Newly-formed carbon compounds give off more radiation due to incorporation in them of carbon isotope 14.

The younger radiocarbon does not have time to decay so much since its formation by cosmic rays in the upper air.

Oldest Frozen Meat

The oldest frozen meat in the world is over 28,000 years old. It is the flesh of a superbison preserved in the permanently frozen ground of northern Alaska. This naturally refrigerated meat is probably older, as its age was

beyond the reach of the radiocarbon dating method. It is nearly three times as old as the earliest evidence of man yet obtained on the North American continent. Dogs and men feasted upon such ancient bison meat when it was uncovered.

Mayan Calendar Settled

Another result of radiocarbon dating announced by Dr. Kulp seems to have settled the controversy over the Mayan calendar. The ancient peoples of Mexico and Central America had a very accurate system of dates, but the correlations with the modern calendar differ by 200 years. Now the Spinden correlation has been proved correct since a beam over a doorway with a Mayan date upon it has been dated at 1,470 years ago. This makes the Mayan civilization more ancient.

Isaiah Manuscript Antique

The recently discovered manuscript scroll of the Old Testament book of Isaiah is a genuine antique and not a medieval forgery, another radiocarbon dating proved, although the method does not have sufficient precision to tell whether it was written a century or two B.C. or in the second century A.D.

Radiation Hazards

➤ THE DEVELOPMENT of atomic energy for both war and peacetime uses may be creating radiation hazards, including the radioactive contamination of water, the American Society of Civil Engineers was told by Roy J. Morton of the Government's nuclear laboratories at Oak Ridge, Tenn.

Recent developments in the field of nuclear energy have created potential health hazards whose evaluation and control are sanitary engineering problems, he said. Among these problems is the possibility that, in the future, water supplies in this country may contain greater amounts of radioactive materials than in the past. Whether the increase in radioactive water contamination will be generally appreciated or will cause significant hazards in a particular locality can not be predicted.

While health problems due to radioactivity are new, complex and technically different from other problems of environmental sanitation, they are similar to other problems of sanitary control, he continued. The sanitary engineer does not have to be a nuclear physicist to attack them. The basis of ability to cope with radioactive contamination is experience in the routine detection, prevention and elimination of less dangerous or less extreme degrees of contamination.

Atom-Powered Industries

➤ BUSINESSMEN are warned not to let the atomic age catch them napping. P. J. Lovewell of the Stanford Research Institute, Stanford, Calif., says that manufacturers, processors and power utilities will be among the first to be affected by atomic energy's peacetime uses.

Atomic industrial processes may be introduced on a modest scale within five years. In 10 to 20 years, the effect in the business world should be generally felt.

Businessmen should stay abreast of the latest industrial atomic energy developments so that their processes will not become outdated, placing them in an untenable competitive situation.

Mr. Lovewell was one of 10 speak-

ers to discuss the industrial applications of atomic energy in a symposium held in Chicago in connection with the Seventh National Chemical Exposition.

Breeder Reactor's Core

➤ THE HEART of the Atomic Energy Commission's experimental breeder reactor at the National Reactor Testing Station near Arco, Idaho, is an atomic fuel-holding core no bigger than a regulation football.

Yet from that small core, enough neutrons are sent crashing through a blanket of natural uranium to generate electric power sufficient to supply the entire laboratory's needs. And at the same time, precious plutonium is created.

Alfonso Tammaro, manager of the AEC's Chicago operations office, told the American Society of Mechanical Engineers recently that the process of generating electric power from atomic fuel may eventually become competitive with present-day generating methods.

Basically, the breeder reactor works like this: A blanket of natural uranium surrounds an atomic fuel-holding core. Neutrons shot out by the core are absorbed by U-238 atoms in the blanket. That produces plutonium, an atomic fuel vital in the production of atomic weapons.

The uranium blanket is suspended around the core in a sodium-potassium alloy coolant enclosed in a cylindrical tank. A reflector around the tank bounces neutrons back into the reactor that otherwise would escape. A thick lead-and-concrete shield goes around the whole works.

Unique mechanical and nuclear devices in the core control the chain reaction inside to prevent a reactor runaway and to keep temperatures from becoming too high. If the temperature gets too high, the tank and fuel will melt.

The sodium-potassium coolant, at about 625° F. carries heat off to a heat-exchanger which is needed because the coolant itself is radioactive. The heat-exchanger transfers the heat to a nonradioactive sodium-potassium cooling system. That, in turn, carries it to a second heat-exchanger which transfers the heat to water. Steam is generated to turn turbogenerators and to produce 250 kilowatts of power, more than enough to supply the laboratory's needs.

The experimental breeder reactor was not built to test the feasibility of generating electric power by atomic means. But technical information gained from the Arco reactor should be useful when engineers aim at a reactor capable of generating electric power competitively.

Shoot Radioactive Cobalt Through Pneumatic Tubes

➤ NOW SCIENTISTS are shooting radioactive cobalt from one room to another in a pneumatic tube transfer system like that used to carry cash in a department store.

The capsules containing the radioactive cobalt, however, are loaded into the pneumatic tubes by remote control. And they run in an S-shaped curve through a five-foot barrier of scrap iron, lead shot and barite aggregate.

This pneumatic tube transfer system is one feature of the Navy's gam-

ma ray generator at the Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md.

The generator is said to be the first of its kind anywhere. It was specially designed to give complete, uniform, total body irradiation of target materials. It will be used for research on the effects of total body radiation by gamma rays on a variety of target materials, similar to those exposed in atomic bomb tests. Gamma rays, like X-rays, do not make the target material permanently radioactive. Before this generator was completed, existing gamma ray sources irradiated targets from at most a few directions, according to where the sources of the rays were placed.

The generator is housed in a specially constructed shielded building 47 x 30 x 12 feet. A T-shaped barrier divides the building into two exposure rooms and a control room.

Operation of the generator is accomplished by a pneumatic system. A single compressor, located in the control room, delivers a seven-pound positive or negative air pressure to each of the transfer tubes. The pneumatic system, from the compressor manifold, in banks of five, is connected to each generator tube in exposure room #2. By this system, all or a part of the cobalt-60 in the pneumatic tubes can be sucked into exposure room #2 or blown into exposure room #1 as required.

Cobalt 60 is the radioactive isotope which takes the place of scarce radium and can be used for experiments for which there is not enough radium in existence.

Twice the world's present supply of radium, which if obtainable would cost $130,000,000, would be needed to equal in intensity the rays from a powerful radiation source recently installed at the Knolls Atomic Power Laboratory, which is operated for the Atomic Energy Commission by the General Electric Company.

So intense is this radiation that it causes a bluish-white glow in the nine-foot depth of protective water under which the source is kept. When the room is darkened, the tank and the surrounding area are illuminated by this glow.

According to Dr. Kenneth H. Kingdon, technical manager of the laboratory, the source consists of about 2.5 pounds of a radioactive form of the metal cobalt, known as cobalt 60. The radiations emitted are gamma rays or high-energy X rays.

The laboratory will use the new installation in connection with its work on the design and construction of a full-scale, land-based model of an atomic power plant for U. S. Navy submarines.

Physical properties of many materials to be used in constructing such a plant may be altered by the powerful rays generated in the atomic reactor. By lowering samples of these materials into the water, and exposing them to rays from the cobalt 60, such effects may be tested on a small scale. Other testing of the effects of irradiation on materials is done in nuclear reactors.

Common glass is one material that is markedly changed by the rays; it turns a deep brown. One engineering assistant at the laboratory took advantage of this to make a pair of sun-

glasses, by exposing an ordinary pair of glasses to the rays overnight. Such coloration of glass, however, is not permanent, but gradually fades out. Baking at a relatively high temperature very quickly restores the glass to its original clarity.

The radioactive cobalt is contained in ten cylindrical capsules, mounted in holes in a steel plate. They are kept at the bottom of a concrete pit and, with the aid of submerged lights, may be clearly seen through the nine feet of water covering them. Remote control devices permit them to be handled at a distance if necessary, and allow test samples to be placed in position around them.

Ordinary cobalt, a metal closely resembling nickel and not radioactive, may be made radioactive when it is placed in an atomic reactor and bombarded with neutrons.

Ordinary cobalt is cobalt 59. When it is bombarded with neutrons, one neutron may stick, thus converting the isotope to the heavier cobalt 60, which is radioactive. After 5.3 years, half of a given amount of cobalt 60 changes into an isotope of ordinary nickel, and gamma rays are given off as the process takes place.

The cobalt 60 source was purchased by the laboratory, at a cost of approximately $20,000, through the AEC Isotopes Division at Oak Ridge, Tenn. This is the central clearing house for radioactive isotopes prepared in U. S. atomic reactors.

Cobalt 60 has also been made available by the AEC as a source of radiation to be used by physicians in treating cancer, and the General Electric X-ray Department has produced a unit in which it may be safely used. Such sources, however, are less than a third as large as the new one in the Knolls laboratory. Radioactivity is measured in units called curies (after Madame Curie, the discoverer of radium). The new laboratory source is rated at 3400 curies, compared with 1000 curies for the medical units.

On the Back Cover

▸ ONE HUNDRED AND THIRTY *million dollar's worth of radium, twice the world's present supply, would be needed to equal the rays from this powerful radiation source in the Knolls Atomic Power Laboratory, operated by the General Electric Company for the Atomic Energy Commission. The actual source, which consists of cylinders of cobalt made radioactive by exposure in an atomic reactor, is at the bottom of a nine-foot deep tank of water which protects personnel from its rays. Checking the source and its radiations are Dr. Samuel S. Jones and Rudolph Fox of the laboratory staff.*

The source will be used for measuring the effects of high-energy radiation on various materials being used in connection with the land-based submarine atomic power plant the laboratory is constructing for the U. S. Navy. A sample of such a material may be lowered, through the long vertical tube, to the bottom of the tank, where it is surrounded by the radioactive cobalt rods.

Surer Medication
Better Prevention

Protection From Bomb Blast Injuries

➤ WHEN AN A-bomb explodes, does its tremendous force hurl minute particles of dust and other matter through the air with such force that they penetrate the skin of persons in the immediate vicinity?

This is the subject of research being done by Dr. Benedict Cassen and Brian Dunne at the University of California's Atomic Energy Project.

If such particles are radioactive, they could be hazardous upon penetration of the skin, Dr. Cassen points out. One objective of his research is to determine under what conditions penetration might occur.

A needle-less hypodermic syringe that shoots solutions through the skin by the use of a supersonic jet device is being used in the initial phase of the study. This phase is concerned with the behavior of the jet.

The jet stream is observed by means of a spark shadowgraph. This instrument generates a flash so brilliant that the detailed shadow of structural features of the stream can easily be recorded in less than one-millionth of a second.

Inhaled Radioactive Dust

➤ STUDIES with rabbits at the University of California's Atomic Energy Project indicate that inhalation of insoluble radioactive dust may not be as serious as previously thought because of built in safety factors inside the body.

Research by Dr. George V. Taplin has shown that certain mechanisms in the respiratory tract remove insoluble foreign particles in a few days.

These mechanisms in rabbits include secretions from respiratory membranes, small hair-like projections and certain scavenger cells. Similar mechanisms in man would perhaps react the same way, he thinks.

Further investigation revealed that simultaneous whole-body radiation increased the efficiency of these mechanisms. A temporary depression of scavenger cell activity occurred. Later on, however, they became overactive.

This depression of scavenger cell activity may be a cause of many illnesses and deaths resulting from radiation injury, said Dr. Taplin. It enables bacteria in the body, normally held in check, to invade the blood stream.

This suggests that use of drugs stimulating scavenger cell activity together with certain antibiotics might reduce the number of radiation deaths considerably.

Penicillin Treatment

➤ VICTIMS of atomic bomb attack who have gotten burns as well as non-fatal doses of radiation might be saved from death by penicillin, Dr. Everett I. Evans, professor of surgery at the Medical College of Virginia, Richmond, declared in a report at a Symposium on Trauma held at the Army Medical Service Graduate School, Washington, D. C.

A combination of non-fatal burn and non-fatal dose of radiation can be killing, even if neither alone would be fatal, Dr. Evans found in studies of experimental animals.

The addition of 100 roentgens external radiation (400 roentgens or more constitutes a lethal dose) to a standard burn injury resulted in a sharp increase in mortality. A mortality of 12% from the burn alone increased to 75% with the addition of 100 roentgens total body gamma radiation and to 20% with the addition of only 25 roentgens total body gamma radiation.

Of the mechanics by which mortality rises, Dr. Evans says, with combined thermal and radiation injury, entrance into the blood of non-hemolytic streptococci is shortly followed by invasion with more virulent beta hemolytic streptococci, which brings about a fatal septicemia in 75% of the animals. It appears likely that radiation (well below the lethal level) depresses the phagocytic activity and other defense mechanisms to a point where they are unable to localize the beta streptococci at the wound surface. The beneficial influence of penicillin therapy, in reducing sharply the mortality of experimental animals receiving the combined thermal and radiation injury, points to the need for provision of this therapy for victims of atomic bomb attacks, and provides hope that such therapy may reduce the mortality from such combined injury.

The studies and results reported here should not be confused with those in which lethal amounts of external body radiation are used, Dr. Evans warns.

Thigh Shields Protect

➤ LEAD SHIELDS on the thighs give protection against radiation, at least to one strain of mice, Drs. Henry S. Kaplan and Mary B. Brown of Stanford University School of Medicine find.

Lead thigh shields would be as impractical for human protection against atomic radiation as the lead vests for spleen shielding which earlier experiments showed also protected mice.

The point of the Stanford experiments, however, as reported in the journal, *Science*, is that apparently any shielding which protects bone marrow is helpful against radiation injury.

The mice in the thigh shield experiments were a strain of C57 blacks which consistently get tumors of the thymus gland as a result of radiation over the entire body. With the lead shield on one thigh, tumors did not develop. At first the animals showed the same injury to their thymus glands as mice without lead shields under irradiation. But the glands of the thigh shielded mice recovered much faster.

The marrow in the shielded thigh bone apparently was able to provide enough protection against the radiation damage.

Cadmium Atomic Goggles

➤ ATOMIC GOGGLES to protect human eyes from neutrons and other atomic energy radiations and even atomic bombs are now available.

The new glass, containing cadmium, has been developed by a group of University of Pittsburgh scientists, headed by Dr. Alexander Silverman.

It was announced at Point Marion, Pa., at the 50th anniversary celebration of the L. J. Houze Convex Glass Co., sunglass makers, as the world's first practical transparent absorber of neutrons.

Neutrons are penetrating particles of atomic fission. They damage eyes insidiously. To get equal protection, the new glass need be only three times the thickness of pure cadmium sheet.

The new goggles will be used in atomic energy plants, at atomic test explosions and around atomic accelerators. The glass will be used in peep holes in atomic installations.

Transparent glass 50% more absorbent of X-rays and gamma rays than any previous shielding glass was also reported.

New Building Manual

➤ LITTLE OR no thought of protection against atomic bomb blast is being put into the $20 billions a year of new building construction of all kinds, the Federal Civil Defense Administration charges.

The charge was made in a new manual issued by the agency called Windowless Structures, A Study in Blast-Resistant Design. It tells how a building can be constructed so as to withstand the terrific blast from an atomic bomb.

New buildings, the authors of the manual say, can be designed to take advantage of the fact that the pressure of the blast from an A-bomb drops to zero in less than a second. It is during that fraction of a second that the bomb delivers a punch that cannot be taken by buildings designed before the atomic era.

The windowless structure that the manual recommends is designed to give with the atomic blow and absorb it. The building is left somewhat deformed, but the people inside can go right on working with no damage.

The manual is designed as an introduction to the problem of making our buildings atom-blast proof. The windowless structure is not offered as an exact model for all new buildings, but many of the principles demonstrated, say the authors, can be incorporated into new construction now being planned.

The new methods were developed by Ammann and Whitney, New York, consulting engineers. Consultants included Prof. N. W. Newmark of the University of Illinois and Drs. John B. Wilbur, Charles H. Norris and Robert J. Hansen of Massachusetts Institute of Technology. Methods of evaluating the force of an atomic blast were prepared by C. W. Lampson and J. Meszaros of the Army Ballistic Research Laboratories.

Big Plastic Bottles Can't Break

➤ THE WORLD'S largest unbreakable plastic bottles are used for transporting large quantities of poisonous or corrosive acids.

Capable of holding 13 gallons, these flexible polyetheylene containers are blow-molded in one piece by Plax Corp., Hartford, Conn. Used in plywood containers designed by Greif Bros. Cooperage Corp., Delaware, Ohio, they form the first smash-proof carboys ever produced.

Ice Cream Substitute Tastes Same, Cheaper

Foreign Fats Product—New Dessert

by JANE STAFFORD

➤ ARE WE going to have a substitute for ice cream? Will your sundae or cone or the carton you take home for dinner have ice cream in it? Or will it be filled with what is called in trade circles a "foreign fats product"?

"Foreign fats" mean vegetable fats or oils instead of butter fat or cream.

In some quarters this new product is considered a substitute or synthetic ice cream. The situation is said by some to be like the oleomargarine-butter situation.

Not so, says the International Association of Ice Cream Manufacturers. This group looks on the new product simply as a new product. A manufacturer may make ice cream, sherbet, ices and now, or in the future, this new product. He will not call it ice cream, but will give it a "fanciful" name, such as Freezert or Partyfreeze.

The new product will taste very much like ice cream. Some say only an expert ice cream judge can taste the difference. It will sell at a lower price than ice cream. In one large city where it is now on the market, the price, I am told, is 19 cents a pint.

Nutritionally, ice cream and the new "foreign fats product" are almost the same. Both probably furnish about the same number of calories per serving and the same quantity of non-fat milk solids. Flavorings are the same. But, unlike oleomargarine, the cottonseed, soybean, peanut or whatever vegetable oils are used in the new kind of ice cream are not fortified with vitamin A.

Whether you can now buy the new "foreign fats product" instead of ice cream depends on where you live. In Texas you can get it. It is sold there under the name Mellorine. This state has already established standards for the product and any Mellorine sold there must come up to those standards and be sold as Mellorine.

In Illinois, a State Supreme Court decision now allows sale of the new "foreign fats product," and it is apparently being sold there under various names coined by the manufacturers.

In Oklahoma and Missouri, "weak laws" governing ice cream standards allow sale of the new product.

In Kansas, manufacture and sale of a soya frozen dessert was started but stopped by a restraining order and the case is now pending before that state's Supreme Court.

The U. S. Food and Drug Administration has no jurisdiction over this new product of ice cream manufacturers unless it is shipped for sale or barter across state lines. So far, Food and Drug officials have not heard of this being done. Federal standards for ice cream itself are now in process of being established. The Food and Drug Administration is resuming hearings and testimony will be given on the use of surface active agents, that is,

quarternary ammonium compounds, as emulsifiers in ice cream.

Most states have very strict laws prohibiting the use of "foreign fats" in ice cream or any product sold in semblance of ice cream.

A new kind of carton, sales in factory-filled packages only, special labels and advertising are considered by some ice cream manufacturers as necessary to prevent deception of the consumers with the new product.

The new product can be made with regular ice-cream-making equipment, except in California where a state law prohibits this. So far, all of the new product is being made by ice cream manufacturers in addition to their regular line. The one known exception is a manufacturer in St. Louis who makes this product exclusively. He had previously made another dairy product, but not ice cream.

Tell Time of Death in Police Cases

➤ A PROFESSOR of botany who could tell the rate of growth of a vine and the season at which it had its growth helped a coroner solve a dead-body mystery, the coroner, Dr. S. R. Gerber of Cleveland, told the American Association for the Advancement of Science at a recent meeting.

The "Time of Death" symposium at which Dr. Gerber spoke was crammed with scientific facts detective story writers and even gangsters would find useful although it was planned to help law enforcement officials, doctors and the general public in pursuit of justice.

The botany case reported by Dr. Gerber was one in which a tendril of vine was growing through the hair of the corpse when found. The body was nearly completely decomposed. And the validity of a divorce and marriage as well as the disposition of considerable property would be affected Dr. Gerber knew, by the date of death in this case. So the professor of botany was called in to tell about the vine's growth.

Bacteriologists and entomologists can also help solve mysteries by correlating chemicals manufactured by putrefying bacteria with the life cycles of insects and larvae invading a body found some time after death.

Specialists in telling the mineral composition, structure and texture of rocks, by analyzing the dirt on a child's clothing and body, were able to rule out the probability of a hit-run accident having killed a little girl found dead of wounds that could have been made by a broken grill of a car.

These and other examples were given by Dr. Gerber of what he calls "associated evidence."

"It is only in the detective stories of fiction," he pointed out, "that the case is solved by one fact alone."

Associated evidence, though not infallible in itself, should be weighed against all other evidence before reaching a conclusion about the time of death. And many branches of science can be used to study and give the meaning of this associated evidence.

From Laboratories to Hospitals
Chemicals Go for Hopeful Testing

New Drugs Against Disease

In the continuous attempts of those who make new chemicals or apply old chemicals to new ills, there are often promising results that may postpone death in the future and prolong lives.

Seizures of Epileptics

➤ AMMONIUM CHLORIDE, a chemical best known for its use in tinning soldering irons, reduces and sometimes eliminates epileptic seizures. The usual doses of phenobarbital or Dilantin must be used with the chemical, Drs. Fritz Kant and Warren E. Gilson of the University of Wisconsin Medical School have reported.

Epileptic seizures may be the result of damage or irritation to some area of the brain or may occur without known cause. Doctors have known for years that drugs like phenobarbital or Dilantin cut down the activity of the central nervous system and help prevent seizures. They also have known that keeping a patient dehydrated and maintaining a relatively acid condition in his body are other helps.

Keeping the acid condition by diet and the low allowable limits for intake of fluids and salt, however, made long-range treatment nearly impossible.

Drs. Kant and Gilson chose ammonium chloride as a drug having the needed dehydrating and acidifying effect. The two scientists have not had a single case that has not shown some improvement in nearly two years of clinical research. Epileptics who never responded satisfactorily to any other treatment have found happier, more normal lives because of the ammonium chloride treatment.

Severe Epilepsy Attacks

➤ GOOD RESULTS with a new drug for treatment of epilepsy are reported by Dr. R. Handley, director of the David Lewis Epileptic Colony at Warford, Cheshire, and Dr. A. S. R. Stewart of the medical department of Imperial Chemical (Pharmaceuticals) Ltd., in England.

The drug is closely related to the sleeping medicine, phenobarbital, but is of a chemical type not previously used in humans. Chemical name for this white, crystalline, practically tasteless substance is 5-phenyl-5-ethyl-hexahydropyrimidine-4:6-dione. The manufacturers have given it the trade name, Mysoline.

Trial of the drug was made on 40 patients of both sexes between the ages of 16 and 60. All of them had the grand mal type of epilepsy. They had been getting various other anticonvulsion drugs for many years but still were having major convulsive attacks oftener than once a month and in one case about four a day.

With the new drug, 12 of the 40 patients were completely free from attacks of all kinds. All the others except one patient were improved. The one was significantly worse.

In many patients who still had attacks, the convulsions were often much less severe and recovery was quicker.

The patients said they were able to resume work more quickly and that the "hangover" time was less. Those whose attacks came only at night were able to do a full day's work.

The hypnotic effect of some other epilepsy drugs was lacking. Patients felt fit, mentally alert, were better able to perform small tasks and had a new interest in pastimes such as dancing.

The new drug is not yet freely available.

Acne Complications

➤ ENCOURAGING results in preliminary trials of a new antibiotic medicine for germ diseases are reported by Drs. Fordyce R. Heilman, Wallace E. Herrell, William E. Wellman and Joseph E. Geraci of the Mayo Clinic, Rochester, Minn.

The new antibiotic is known as erythromycin and also as ilotycin. It comes from an organism called Streptomyces erythreus, the latter word referring to the color red. It was discovered by Dr. J. M. McGuire and coworkers at Eli Lilly & Company, Indianapolis.

One of the 40 patients who got some of the new antibiotic was a 21-year-old man who had a badly infected skin with abscesses under the skin-complicating acne. Within a few days after treatment with erythromycin the skin infection showed pronounced improvement. He subsequently was able to have a sandpaper treatment for the acne.

Erythromycin has so far been given by mouth. A form suitable for injection into the veins will, it is hoped, become available in the near future.

The antibiotic does not seem to have any serious toxic effects. Some patients had digestive disturbance, nausea and vomiting when maximum dosages were given.

Erythromycin is much like penicillin in the germs it attacks. In addition, it is effective against the organism that causes whooping cough. It has "remarkable activity" against a group of germs belonging to the Corynebacterium family. Included in this group are the germs of diphtheria and of some diseases of sheep, horses and cattle. The Mayo doctors suggest that it should be tried in cases of these infections. Some germs may gradually become resistant to this new antibiotic.

Parkinson's Disease

➤ SOME PATIENTS with Parkinson's disease, also called paralysis agitans and, popularly, shaking palsy, may soon be getting a trial of a new medicine, W-483, following reports on it by Drs. William H. Timberlake and Robert S. Schwab of Harvard Medical School and Massachusetts General Hospital.

The new medicine is called Parsidol in Europe, Lysivane in the British Commonwealth, and W-483 by the Boston doctors. Chemically it is (Diethyl amino-propyl)-N-dibenzoparathiazine hydrochloride.

The Boston doctors tried this new medicine in a group of patients coming to the Out Patient Department of the hospital about once a month and also in a group of private patients who saw their physicians or called them on the phone much oftener.

In the Out Patient group 19% improved on the new drug, compared to 53% of the private patients. The difference, apparently, was because adjusting the dosage and changing from

the drug the patient had been getting could be done more satisfactorily when the doctor could see the patient regularly and oftener than once a month.

In the case of one patient cited, it took 11 weeks to reach a dosage schedule that gave an "excellent result." And in this case it was found that the patient had to take Artane and Dexedrine with W-483. In fact, the doctors state in their report to the New England Journal of Medicine, W-483 was "most efficient when combined with other drugs."

Cortisone in Eyes

➤ CORTISONE in your eye can be more than a mere medical toast to alleviate inflammations and stop destruction of eye structure.

Drs. Max Fine and Rufus C. Goodwin of the Stanford University School of Medicine, San Francisco, Calif., report in the Archives of Ophthalmology that local administration of the anti-arthritis drug can hold many eye infections in check until wonder drugs or nature produce a cure.

Heal Difficult Operations

➤ TWO CHEMICALS made from germs can be used to speed the healing of troublesome wounds of the lower intestinal tract following removal of cancer.

Successful use of streptokinase and streptodornase, chemicals made from hemolytic strep. germs, is reported by Drs. Oliver H. Beahrs and George L. Jordan, Jr., of the Mayo Foundation. The blood clots, pus and other waste products of the operation are liquefied by the chemicals when they are injected four to six times beginning three days after the operation.

Complete healing of such operations involving resections has taken three to six months or longer heretofore. But with the two chemicals, which have been used by other surgeons in the past couple of years to aid healing of other infected wounds, the patient is completely well usually in about three weeks.

The two strep. chemicals do not act like antibiotics to check the growth of disease germs, but they may be used with antibiotics.

Relief for Muscle Spasm

➤ A NEW DRUG that promises to help victims of cerebral palsy, infantile paralysis and other nerve-muscle diseases by relieving muscle spasm was announced by Dr. Virgil C. Boekelheide of the University of Rochester.

The new drug is called apo-beta-erythroidine. It is derived from the curare-like drug, beta-erythroidine. Dr. Boekelheide and associates have also succeeded in determining the chemical structure of beta-erythroidine, a feat hailed by fellow scientists as "an intellectual accomplishment of great value" in addition to its potential practical value in medicine.

The erythroidine bean, found principally in Guatemala and South America, is the natural source of the drug. With the chemical structure of the drug known, scientists may be able to develop other compounds that will advance the treatment of disabilities resulting from accidental or disease injury of the nerve and muscle systems.

The new drug developed by the Rochester group, apo-beta-erythroidine, has a longer-lasting action in relieving muscle spasm than other drugs

used for this purpose, tests on laboratory animals show.

Collaborating with Dr. Boekelheide in the chemical research and testing of the drug were Dr. R. Plato Schwartz of the School of Medicine and Dentistry and Drs. George Sauvage, Michael Grundon, Joseph Weinstock and Eugene Agnello. The chemical research is reported in the Journal of the American Chemical Society.

Painful Keloids

➤ SUCCESS with a new treatment for ugly, often itchy and painful keloids was announced by Dr. Theodore Cornbleet of the University of Illinois College of Medicine to the American Medical Association.

Keloids are an abnormal growth of connective tissue. They often appear in scars from wounds and burns. Many atomic bomb victims in Japan developed keloids.

X-ray treatments, freezing with liquid nitrogen, and surgical removal followed by X-ray treatment are methods that have been used in the past to treat these stubborn growths. In many cases, "the cure is worse than the disease," Dr. Cornbleet said, pointing out that for that reason nothing may be done.

The successful treatment he reported was to inject the keloids with an enzyme chemical called hyaluronidase. This body chemical is also sometimes called the "spreading factor."

Dr. Cornbleet gave this treatment to 11 patients, nine of whom had old, hard keloids that had been present for several years. Two of the patients had many pea- and bean-sized keloids from previous acne. Two had the ordinary crab-like type across the chest. The rest had bulky keloids on their bellies, mostly the result of surgical operations.

The treatment was successful in all cases. Pain, tenderness and itching gradually waned and disappeared. The keloids softened and shrank to three-fourths or one-half their original height above the skin. The remaining excessive tissue wrinkled and was then cut away. None of the keloids returned after this treatment.

Hyaluronidase was successful, Dr. Cornbleet believes, because of its ability to soften the glue-like mass that holds cells together in body tissues.

This chemical is also proving useful in prevention of kidney stones, Drs. Arthur J. Butt and Joseph Q. Perry of Pensacola, Fla., Ernst A. Hauser of Cambridge, Mass., and Joseph Seifter of Philadelphia reported.

For this condition, patients get injections of the chemical every 24 to 48 hours. Its effect in preventing formation of sediment in the urine can be seen within 30 minutes. Formation of new kidney stones is halted and growth of existing ones is stopped.

Kidney Stone Formation

➤ EIGHTEEN OUT of 20 patients have been kept free from kidney stones over a period of 11 to 15 months by treatment with an enzyme chemical, Drs. Arthur J. Butt of Pensacola, Fla., and Dr. Ernst A. Hauser of Massachusetts Institute of Technology announce.

The enzyme chemical is hyaluronidase. It is given by injections under the skin. The patients treated all had a tendency to rapid kidney stone formation.

Jelly-like chemicals called colloids

normally protect against kidney stone formation, these scientists have found. Hyaluronidase causes a pronounced increase in urinary colloids and therefore prevents kidney stone formation.

The importance of colloids in relation to kidney stone formation was announced by Drs. Butt and Hauser at an American Chemical Society meeting in June 1951. At that time, "encouraging results" were reported for the enzyme treatment. Continuing good results are reported in the journal, Science.

Discovery of the action of protective colloids, the scientists state, may "open up a new and hitherto neglected field for medical science far beyond the treatment for kidney stones."

They base this statement on recent findings that formation of protective colloids virtually disappears during times of strong emotional stress.

Relieves Kidney Pain

➤ PATIENTS with multiple sclerosis and others with acute kidney colic can be helped by a medicine now chiefly used for stomach ulcer patients. The medicine is banthine. Its use in these other conditions, and a warning against giving too much of it as an ulcer medicine to men with prostate gland trouble were reported by Drs. Jack Lapides and Austin I. Dodson of the University of Michigan, Ann Arbor, to the American Medical Association.

The excruciating pain of kidney colic can be relieved in three to five minutes by an injection of banthine into the veins. Multiple sclerosis patients can be relieved of one of their most distressing symptoms, failure of normal bladder function, by taking banthine in pill form.

Ulcerative Colitis

➤ GOOD RESULTS with a Swedish drug for treatment of ulcerative colitis are reported by Dr. Lester M. Morrison of the College of Medical Evangelists.

The drug is an azo dye combination of a sulfa drug and salicylic acid. It is called azulfidine. It was developed by A. B. Pharmacia, Upsala pharmaceutical firm, at the suggestion of and in collaboration with Prof. Nanna Svartz of the Carolinian Institute, Stockholm.

Of 42 patients who had the full course of treatment, 20 showed "great improvement" and 10 temporary improvement. Reporting his results and commenting on Dr. Svartz' 90% cure or greatly improved rate in 124 patients, Dr. Morrison called the drug "the most promising to date" for ulcerative colitis. Details of his studies are reported in the Journal of Gastroenterology.

Schizophrenic Trances

➤ A FEW PATIENTS have now been rescued, temporarily, from the death-like catatonic trance of the mental disease, schizophrenia, by injections of a chemical into their brains, a group of doctors and research scientists from London, England, and Chicago and Manteno, Ill., reported to the Society of Biological Psychiatry.

From a rigid, mute and helpless state, patients begin to move, talk and lose their gray pallor. One even could work, go to parties and dance.

The scientists reporting the work on patients and research on cats in catatonic trances from brain injury are: Dr. Stephen L. Sherwood of the Middlesex Hospital, London; Drs. Warren S. McCulloch and P. M. Cooke and Miss Ellen Ridley of the

University of Illinois College of Medicine, Chicago; and Drs. W. H. Mosberg, T. N. Tausig and A. P. Bay of the Illinois State Hospital for Mental Diseases, Manteno, Ill.

In some of the patients given this new chemical treatment, improvement lasted only half or three-quarters of an hour. In others the improvement has lasted for eight or nine months. All were patients who for years had been lying helpless in their trance-like state, needing to be fed and cared for in every way like a baby, and who had not been helped by any other form of treatment.

Some patients relapsed soon after treatment and then began to improve again spontaneously without any further treatment.

The trial of this new treatment is still too new for doctors to make any guess as to the future. At Manteno it is considered at least promising enough so that plans have been made to give this treatment to more patients.

Some patients who relapse partially or completely can be restored to a more nearly normal state by a second treatment. Whether the injections into the brain can be repeated indefinitely, and how long the periods of improvement will be, are questions that cannot be answered yet.

The chemical used at Manteno is cholinesterase. This is a body chemical which normally destroys the acetylcholine set free when nerve endings in voluntary muscles are stimulated to contract the muscles. The cholinesterase prevents too much acetylcholine from accumulating at nerve endings.

A number of chemicals counteract cholinesterase. Among these is di-isofluorophosphonate. In large doses this chemical produces symptoms resembling some mental diseases and aggravates the signs and symptoms of schizophrenia. These findings, by other scientists, gave Dr. Sherwood the idea that cholinesterase and similar drugs counteracting acetylcholine might reduce symptoms of schizophrenia. First report of his early work and of the Chicago group's study of cats was made in February of this year.

In his work with patients at Severalls Hospital, Colchester, England, Dr. Sherwood tried flaxedil and pentamethonium iodide as well as cholinesterase. The effect was most marked with cholinesterase in the first patient and with the iodide chemical in three cases, he reported in the English journal, Brain.

The doctors at Manteno have been using cholinesterase specially prepared for them.

Stiff Joints and Gout

➤ Good results with a drug that lubricates stiff rheumatic joints and eases their pain was reported by two groups of New York physicians to the American Rheumatism Association.

The drug is phenylbutazone. In spite of causing a fair number of reactions, it "promises to be a superior analgesic" for relieving pain in muscle and joint disorders with slight, if any, anti-rheumatoid action, Drs. Otto Steinbrocker, Sidney Berkowitz, Solomon Carp, Mortimer Ehrlich and Mortimer Elkind reported from their experience.

Quick arrest of acute gouty arthritis which sometimes had been resistant

to the usual anti-gout medicine, colchicine, was one of "the most remarkable effects" in the experience of Drs. E. K. Kidd, K. C. Boyce and Richard H. Freyberg.

Unpleasant reactions, reported by both groups of physicians, consisted chiefly of indigestion, lack of appetite, nausea, bloating, skin trouble, and disturbance of water balance as shown by weight gain and dropsy. No sign of blood disorder was noted.

Fatal Fungus Diseases

➤ A DRUG once put on the shelf as useless is staging a comeback in the fight against serious, sometimes fatal fungus diseases in humans.

The drug is called stilbamidine. It belongs to the chemical group of diamidines. The diseases it is stopping are blastomycosis and actinomycosis. The latter is known as "lumpy jaw" when it attacks cattle. Four patients with the first disease and one with the second began to recover promptly after treatment with stilbamidine was started, Drs. Emanuel B. Schoenbach and Joseph M. Miller of New York reported to the American Society for Clinical Investigation.

Tried in two patients with brain inflammation from infection with the yeast-like fungus called Torula, the drug did not help. However, the two doctors recommend further trials of stilbamidine and related chemicals in treatment of the fungus infections that attack not only the skin but the entire body.

Muscle Weakness Treated

➤ A NEW APPROACH to treatment of the muscle weakness disease, myasthenia gravis, is promised by a chemical related to the synthetic detergents, or soapless soaps, and named Tensilon, or, chemically, 3-hydroxyphenyl dimethylethylammonium chloride.

Tensilon injected into the veins of patients with myasthenia gives a prompt though not lasting increase in strength, Drs. Martha R. Westerberg, Kenneth R. Magee and Frederick E. Shideman of Ann Arbor, Mich., reported to the American Academy of Neurology.

Even patients already on treatment with neostigmine or other medicine for myasthenia gain extra if transitory strength from the Tensilon injection.

The effect of the drug is a direct stimulation at the nerve-muscle junction and is not related to any anticholinesterase activity. For this reason, the Michigan doctors consider it holds promise of a new approach in both treatment and study of the disease.

Miniature Atom Smasher

➤ NOW VERY small "atom smashers" are being built and put to work. Dr. H. F. Kaiser of the Naval Research Laboratory has described a microtron, a miniature electron cyclotron. It operates in the same frequency band as three centimeter radio waves. Its principle was proposed theoretically and then was applied in Canada to a somewhat larger instrument.

Artificial Camphor

by BURTON L. HAWK

➤ THERE IS obtained from turpentine a white crystalline solid known as bornyl chloride. Because this substance has the appearance and odor of camphor, it has often been called "artificial camphor." It is not too important a compound in itself, but it is used as a starting point to prepare *synthetic* camphor. Now, you do not want to confuse the terms "artificial" and "synthetic." Artificial is an imitation of the real thing, whereas synthetic *is* the real thing. Thus we have *natural* camphor—which is as it is obtained from nature; *synthetic* camphor—the same substance made in the laboratory; *artificial* camphor—an entirely different substance that is similar to camphor.

Common turpentine consists chiefly of α-pinene ($C_{10}H_{16}$) along with a smaller percentage of β-pinene (nopinene). Pure α-pinene boils at 154-156 deg. and β-pinene at 163 degrees. As we need the α-pinene for our experiment, it should not be too difficult to obtain it from turpentine.

Obtain a good grade of steam-distilled wood turpentine from the paint store. Pour 10 cc. of it into a distilling flask and insert a thermometer into the liquid through a one-hole stopper. Connect a tube to the side arm of the distilling flask leading into a test tube externally cooled by immersion in ice water.

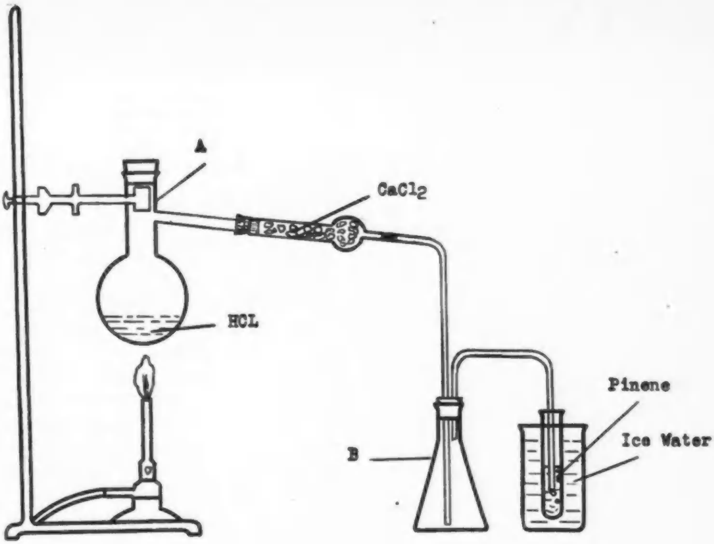
Heat the flask gently and collect all of the liquid that distils over between 154 and 156 degrees. Distil about one-half of it (5 cc.). Be careful, as turpentine is inflammable. Your distillate should be a fairly pure version of α-pinene.

To convert the α-pinene into bornyl chloride, it is necessary to saturate it with dry hydrogen chloride at a low temperature. In order to accomplish this, set up an apparatus as shown in the diagram. The flask 'A' contains 10 cc. of con. hydrochloric acid. The calcium chloride drying tube is attached to the side arm of the distilling flask 'A.' Flask 'B' is placed in the set-up to catch any excess moisture which may drain out of the drying tube. The test tube containing the 5 cc. of α-pinene is immersed in a container of ice water.

Heat the hydrochloric acid gently and allow the dry hydrogen chloride gas to bubble through the cool α-pinene until the latter is saturated. It is difficult to state just when this point is reached; you will have to use your own judgement here.

When dismantling the apparatus, disconnect flask 'B' first; then remove the flame. This will prevent any liquid from being sucked back into the flask.

Bornyl chloride is insoluble in water. Add water to the solution in the test tube, shake well and allow to stand. Note the white solid particles which separate from the solution. Does the odor remind you of camphor?



➤ THE PREPARATION *of Bornyl Chloride from a-Pinene*

Synthetic Camphor

The synthesis of camphor is a bit involved for the home laboratory. However you may be interested in the method which uses bornyl chloride as the starting point. First it is converted into camphene by heating with potassium phenoxide at 180 degrees. The camphene thus obtained is treated with glacial acetic acid at 60 degrees to form isobornyl acetate. Then the isobornyl acetate is hydrolyzed to isoborneol by boiling with alcoholic potassium hydroxide. Finally, the isoborneol is converted into camphor by oxidation with fuming nitric acid. That's all there is to it. Someday when you feel ambitious, you can attempt the synthesis.

Artificial camphor has few commercial uses, but synthetic camphor is highly useful and is manufactured on a large scale. It is used in the manufacture of plastics (notably celluloid), lacquers, varnishes, explosives, in various pharmaceuticals and cosmetics, and, of course, as a moth repellent.

The ten leading causes of mortality in children one to 14 are in order: accidents, influenza and pneumonia, cancer and leukemia, congenital malformations, tuberculosis, acute poliomyelitis, diarrhea and other infections of the digestive system, rheumatic fever, diseases of the heart, and meningitis.

Chemicals in Soil Measure
Age of Ancient Home Sites

Dating Past by Chemistry

➤ A NEW GEOCHEMICAL method dates sites occupied by man in the ancient past. It may be useful for remains so old as to be beyond the 25,000-year limit of radiocarbon dating.

The new method is based on the fact that wherever man makes his home, he enriches the soil through his garbage and other refuse with greater proportions of such chemicals as copper, zinc, tin, lead, gold, manganese and, of course, phosphorus and nitrogen. Thus the site of human occupation is richer in such minerals than unoccupied sites of similar geological character.

With the passage of time the difference tends to dissipate and the chemical makeup of the soil is more like that of neighboring unoccupied areas. Unfortunately, the dissipation does not occur at a regular rate but varies with such factors as the original character of the soil, topography and climate. And so it is not possible to ascribe any pin-point dating to a particular site with this geochemical method. Scientists do hope to be able to use it, however, to find out whether a particular prehistoric campsite is only 1,000 years old, is 10,000 years old or even 100,000.

Trial of the method indicates that it shows up a difference of only 1,000 years between two sites from 1,000 to 3,000 years old.

The despised trash heap onto which man for many ages has dumped his gnawed bones, broken dishes, worn-out tools and other refuse has always been a treasure horde for archaeologists. The archaeologist calls such a dump a "midden." Now the midden promises to have new usefulness. Chemical analysis of its composition may serve to check the archaeologist's own way of dating through study of the signs of tools, patterns of pottery, evidence of the people's occupations and so on.

Dr. V. P. Sokoloff and Dr. G. F. Carter, of the Isaiah Bowman School of Geography, Johns Hopkins University, Baltimore, made a study of two sites in Florida for which dates had already been found on the basis of the design of pottery fragments. One site was 1,000 to 2,000 years old; the other 2,000 to 3,000 years old.

Extractable copper in the subsoil midden materials, it was found, is significantly higher in both than in non-occupied sites, but in the older site the concentration is much more like that of the comparison soil. A period of 1,000 or 2,000 years was not enough to bring the distribution of trace minerals in a midden to that of a comparable undisturbed site.

International specifications for the majority of insecticides and insecticidal formulations used in the control of malaria and other insect-borne diseases have been issued by the World Health Organization.

Tracer, Dilution, Activation New Terms in Analytical Work

Isotopes as Analytical Tools

Extract from an address by Paul C. Aebersold and Edwin A. Wiggin, U. S. Atomic Energy Commission, Oak Ridge, Tenn., presented by Dr. Aebersold before the American Chemical Society's meeting at Atlantic City, Sept. 16, 1952.

➤ RADIOISOTOPES in their best known and most widely applicable role are used as tracer atoms. As such they serve as the basis for a new analytical technique—the tracer technique which because of its combination of sensitivity and unique specificity is the most powerful analytical technique known today. The sensitivity of the method is so great that it is not difficult to work at dilutions as high as a billion (10^9) or ten billion (10^{10}) while dilutions of more than a trillion (10^{12}) are attainable. This would mean detecting a microgram uniformly mixed in over 1000 kilograms or one ounce mixed in over 10 million tons!

In addition, the specificity of the technique permits the independent labeling and tracing of a specific batch of atoms or molecules even in the presence of other atoms or molecules or the same substance, and in spite of multiple reactions with numerous other kinds of atoms or molecules.

Another advantage of the tracer technique is that it is both qualitative and quantitative.

What is often overlooked, however, particularly by those who have not yet employed radioisotopes in their own research, is that the tracer technique does not always replace but often only supplements other analytical techniques. Also, if the tracer technique is to be used for quantitative analysis, one cannot usually eliminate the intermediate chemical steps associated with other analytical procedures. Because of the great sensitivity of radioisotope detection, the chemistry required in tracer analysis may often be even more exacting.

The chemist, working with the physicist, has developed three general ways in which radioisotopes may be used as analytical tools. These may be referred to as "tracer analysis," "isotope dilution analysis," and "activation analysis."

Tracer Analysis

The first and simplest, tracer analysis is designed to follow the fate of a radioelement or labeled material from one stage to a later stage of a reaction or process. It is primarily useful in determining the distribution of a specified material in a variety of end products. Depending on whether the radioactive label is added to the system in known amount, the technique may be either qualitative or quantitative. In either case, the advantages are that the determinations can be made at concentrations far below those permitted by other methods. If the technique is to be used quantitatively, the total amount of material being traced must be determined accurately in the final stage of the reaction process.

Isotope Dilution

Isotope dilution analysis is a modification of tracer analysis. It is particularly suited for determining the amount of a substance in a process or system which is either present at a concentration too low to be measured by chemical or spectroscopic methods or which cannot be quantitatively separated from other materials in the system. The technique is based on introducing into the sample to be analyzed an amount of radioelement of known specific activity, that is, mixed in known ratio with stable atoms of the same element. Any change in this ratio will be due to the dilution caused by the amount of that element originally present in the system. The unknown amount of element originally present in the system is thus determined by the change in the ratio of radioactive to stable element. The advantage of the technique is that it does not require quantitative chemical separation and determination of the total amount of element in the system. It is only necessary to do quantitative work on a small sample, this sample, of course, being chemically pure.

Inverse isotope dilution is used when the labeled material is already present in the system. In this case a known amount of unlabeled compound is added and a sample subsequently removed for a specific activity measurement. The advantages here are that very small amounts or concentrations can be determined and the pure diluting compound added need not be labeled.

The double dilution technique is used when neither the amount nor specific activity of the labeled material is known. By running two dilutions and solving two simultaneous equations, it is possible to eliminate one of the unknowns and subsequently solve for both unknowns.

Activation Analysis

Activation analysis, which incidentally only recently became an integral part of the Commission's isotope distribution program and hence available for extensive use by non-Commission investigators, takes advantage of both nuclear physics and radiochemistry. It is based on the neutron irradiation of an unknown sample in the nuclear reactor, and the subsequent identification of the radioisotopes induced. The various radioisotopes thus produced are identified by their specific radiation characteristics. The technique can be either qualitative or quantitative and is particularly useful where the concentrations of the unknown element are too low to be identified by chemical or spectroscopic methods or where standard methods of analysis are not satisfactory because of interfering contaminants. Sensitivity of detection ranges from 10^{-6} to 10^{-11} grams, that is, this is the amount of an element that will produce sufficient activity to be measured after the element has been exposed to a predetermined neutron flux for a given period of irradiation.

As has already been pointed out, the isotope tracer technique derives its power from its great sensitivity and specificity. Sensitivity is primarily concerned with the detection and measurement of radioactivity and hence is not the primary responsibility of the chemist. Specificity, on the other hand, depends on careful separation and identification procedures, which are

chemical techniques. Further, the final radioactivity measurements in a tracer experiment are only as significant as the preciseness of the techniques used to separate and identify the samples.

The chemist has had to devise new methods and adapt others to meet these strict separation and identification prerequisites. Those employed to date include ion exchange, chromatographic, and isotope derivative techniques. Although time does not permit a detailed discussion of the ways in which these three techniques have been used, a brief description of the latter two may be in order since they may not be as widely known.

Paper Chromatography

Paper chromatography has proved a particularly useful technique since it permits separation and identification to be made in the same operation. The unknown compounds are permitted to move in a solvent along a strip of filter paper. As in the case of column chromatography, individual compounds or mixtures of compounds separate out at various distances from the point at which the solvent was added. Identification of the separated compounds may then be made by comparison with known chromatograms or by a combination of radiochemical and microchemical techniques. Also, autoradiography has been found to be a helpful adjunct to paper chromatography. Recently, two dimensional paper chromatography has been introduced into isotope work. Two dimensional chromatography offers the advantage of a second order of separation. After one solvent has caused the products of an unknown mixture to move along one dimension of the paper, a second solvent is added in such a manner that the newly separated products move in a second path at a right angle to the path of the original separation.

The isotope derivative method, like paper chromatography, will probably find widest application in biological tracer studies. Briefly, it is a method for estimating organic compounds in the form of isotopically labeled derivatives. To a mixture containing the compounds to be analyzed is added a reagent containing an isotope under such conditions that the compounds in question are converted into isotopic derivatives of the reagent. The isotope derivative method becomes quantitative (1) when quantitative yields are obtained of the isotopic derivatives during the reaction with the isotopic reagent as well as in subsequent isolations or (2) when a known amount of the compound being analyzed for, labeled with a second isotope, is introduced into the mixture as an indicator. The recovery of the second isotope in any pure isolated sample of the isotopic derivative may be used to correct for both the lack of quantitative yield and recovery obtained with the derivative of the original isotopic mixture.

Glutamic Acid

For example, to determine glutamic acid in an amino acid mixture, one reacts the mixture with a certain radioiodine labeled reagent, adds a known amount of very pure radiosulfur labeled glutamic acid, and then separates the amino acids by chromatography. If the ratio of counts of radioiodine to radiosulfur is determined in successive small strips over the glutamic

acid band, one can identify with certainty and measure the amount of glutamic acid in the original mixture.

And throughout the course of all tracer experiments the isotope user must be continually aware of pitfalls. Potential pitfalls lie in each of the seven criteria of tracer methodology, namely: radiochemical purity, single chemical state, eliminate exchange error, know the degree to which the tagged molecule remains intact, avoid isotope effect, avoid chemical effects, and avoid radiation effects. It is primarily the responsibility of the chemist to see that such pitfalls don't invalidate the results of tracer experiments.

The future extent of isotope utilization will, of course, depend on a number of factors. For example, it will depend on the continued and expanding availability of isotopic materials, on more scientists acquiring the training to handle and use radioisotopes, and on a wider applicability of the tracer technique. Taking each of the factors separately, we find: first, that future radioisotope production will be sufficient to meet all demands since nuclear reactors have proved their unique ability as production units and increasingly more reactors are being put into operation; second, even though lack of trained people is still a major bottleneck this situation will gradually improve by informal training if not by formal training; and third, scientists in increasing numbers are gaining a general "feeling" for the tracer method to the extent that it is becoming common practice in attacking research problems to see whether the isotope technique can be applied advantageously.

Perhaps the most important long range factor, however, is the question of whether the power of the tracer technique can be improved. For instance, have we arrived at the ultimate in the ability to trace atoms? Is there any possibility of pushing forward the limits of the technique?

It is only by pushing forward the working limits of sensitivity of measurement, and the specificity of separation and identification techniques that the tracer method can be made more productive.

The principal areas in which the tracer method can be improved by physics are production and instrumentation. There have been a number of recent achievements in both areas. For example, the development of high-flux reactors makes it possible to increase the specific activity of radiomaterials produced by neutron-gamma reactions. With an increase in the atom per cent of radioactivity in a tracer material, greater dilutions are permitted in its use.

Sensitive Instruments

The sensitivity of instruments now available permits radiation measurements that are only slightly above background. Using the readily obtainable sensitivity of present commercial instruments and without carrier-free materials, dilutions as high as 10^9 and 10^{10} power have been possible. It has recently become possible by using anti-coincidence methods, such as are used in carbon 14 dating and tritium water analysis studies, to count down to a fraction of the cosmic ray background. Other recent improvements in instrumentation include the development of liquid scintillation counters and improved gas-filled counters.

The combined effect of these improvements in production and instrumentation means that from a purely physical aspect the tracer method is even now being pushed to its utmost—to the theoretical limits of dilution which as previously noted may be greater than a trillion (10^{12}). Certain biological studies have already begun to demand that measurements be made at the greatest possible dilutions. Although further refinements will undoubtedly be made, it is doubtful that these will be able to push forward significantly the physical working limits.

Tracer Technique

We have already noted the contributions of chemistry to the advancement of the tracer technique. Many more, however, remain to be made. A number of newer techniques have not as yet been completely developed or extensively exploited. Of special note are double isotopic labeling, two dimensional paper chromatography, the isotope derivative method and activation analysis. Since the working limits of the tracer method, as far as the physical aspects are concerned, are already being pushed to their utmost, most of the improvements to be made in the future will have to be in the form of chemical advances.

As the physical and chemical techniques associated with the tracer method are advanced, isotope utilization will expand because more and more problems will become subject to study by the tracer method. To make such advances, however, will require the efforts of more investigators. This leads us to the obvious conclusion that we will have to train more chemists in the field.

Numerous references have been made to the need for more chemists trained in handling and using radioisotopes. The radioisotope is one of the most valuable analytical tools now known, yet the chemist seldom uses it, much less is exposed to it, during his educational training. The problem, however, is not as simple as it may first appear.

First, with a few exceptions, such training is not now available. Chemists working with the atomic energy project, of course, obtain experience in handling and using radioactivity. Outside Commission programs, a limited number obtain the necessary rudiments through the basic training course in isotope techniques offered by the Oak Ridge Institute of Nuclear Studies. An even smaller number are fortunate enough to obtain such training in one of the few universities and colleges now offering students the opportunity to study radiochemistry and isotope tracer techniques in formal graduate courses.

Courses Needed

There is no simple formula for immediately answering this need. A lecture-laboratory course incorporated into the curriculum as part of the analytical course work now carried by the chemistry student would be a step in the right direction. It is difficult to say whether such training should be made part of the undergraduate or graduate work. Perhaps it should be offered at both levels. In either case, it would increase the number of chemists who would be able to determine wherein radioisotopes might be used

to advantage in any future research in which they might participate.

But the training problem is much broader than this. The same training should also be made available to the students of physics, biology and other sciences as well. Ideally, the course should be suited for students of different majors. Such a course might logically be offered by the chemistry department. Care should be taken to avoid having the general "isotopes techniques course" become largely a "radiochemistry course," thereby scaring away the physics and biology students. Perhaps this could be done through an intra-departmental effort with faculty representation from each of the departments concerned.

In any event, the isotope technique places a real responsibility on the educator.

In our emphasis on the problems associated with isotope utilization and chemistry's essential role, we have intentionally touched only briefly on the outstanding accomplishments of isotopes, but we should like to point out a few of these accomplishments.

Physiologists have been able to develop new concepts of the dynamic state of body constitutents and to develop an entirely new technique for studying the synthesis, transport, utilization, and breakdown of various body components. Isotopes have contributed immensely to our understanding of photosynthesis and it is now apparent that an understanding of this basic conversion of solar energy to chemical and life energy may someday have great consequences. Isotopes have shed considerable light on our knowledge of the mechanics and kinetics of chemical and physical-chemical reactions. In medicine, isotopes have not only proved a valuable tracer in clinical research but also have proved in a number of instances to be useful diagnostic and therapeutic aids. Isotopes have helped solve problems that could be solved in no other way in nearly every field of scientific and technological development.

Foreseeing an abundant supply of suitable isotopic materials, foreseeing rapid physical and chemical advances to the ultimate limits of the isotope technique, and finally foreseeing educators meeting the need for more trained specialists, we can predict much more extensive and valuable use of radioisotopes in the years to come.

Unsolved Major Engineering Problems

➤ Ten major engineering problems listed by Charles L. McCuen, general manager of General Motors research laboratories, include power direct from the sun, a practical atomic power plant, obtaining fresh water from the sea, and the application of engineering principles to social problems.

The others are more efficient gas turbines and other power plants, processes for obtaining materials from the earth's crust and sea, control of corrosion of metals, development of an adequate highway system, development of new synthetic materials, and disaster control for storms, floods, hurricanes and droughts.

Research Shows Composition
Of Steel, Stars, Stockings

Wave-length Standards Determined

➤ THE COMPLETION of a research that will help reveal the composition of steel, stars and stockings, and will be of wide interest and high importance to the industrial manufacturer as well as to the academic astrophysicist, was reported by Dr. William F. Meggers, chairman of the International Commission on Standard Wave Lengths, at a recent meeting of the International Astronomical Union.

The relative brightness of 30,000 spectral lines in the spectra of 70 different chemical elements have been measured in the course of this work which has been in progress for 15 years. Dr. Meggers is in charge of the spectroscopic laboratories of the National Bureau of Standards in Washington and is one of the leading spectroscopists of the world.

In many industrial processes it is important to know what impurities are present in a critical material and in what amounts. The impurities are frequently so minute that they cannot be detected or measured by ordinary chemical methods. The spectroscope and the arc, however, are exceedingly sensitive. The slightest trace of an impurity is revealed by the appearance of characteristic lines in the spectrum if the electrodes for the arc are made in part of the material under examination.

The spectrum differs conspicuously from element to element because of the varied organization of the electrons in the outer part of the atoms. With the aid of the new tables of the intensities of spectrum lines, the composition of materials as well as the traces of impurities can be determined and the relative amounts accurately measured.

The astrophysicist analyzing the planetary atmospheres or the gaseous composition of stars, nebulae and galaxies, is similarly aided by the new work from the Bureau of Standards. Often spectral lines appear that have not yet been identified with any element. Such lines in the spectrum of a star may indicate that the atomic composition is chemically unusual or that the pressure and temperature conditions on the star's surface are peculiar. The way atoms of any element vibrate and radiate their spectrum lines depends on the pressure, temperature and abundance of those atoms.

Dr. Meggers' intensity measurements, which were all made by him personally on a uniform basis referred to a superposed line spectrum of copper, will also be of astrophysical use in determining for many spectra certain fundamental atomic constants known as "f values" and through them in contributing directly to basic theories of atomic structure. Heretofore such values have been determined laboriously by other methods and for only a limited number of spectra.

The textile, chemical, metallurgical and pharmaceutical industries will be

most benefited by the completion of the new tables of line intensities. In all such establishments the spectroscope and spectrograph are important tools for analysis and testing.

The provision of standards of weights, lengths and material qualities for industry is one of the functions of the National Bureau of Standards and much basic research is a necessary part of the work.

The 70 elements studied by Dr. Meggers are all of those that show spectrum lines in the direct current arc which are suitable for intensity (brightness) measurement. The 28 elements omitted from the tabulation include the six new artificially-created radioactive elements, that have atomic numbers greater than 92, the number for uranium.

Also omitted are the five halogens (chlorine, iodine, etc.), the six noble gases (neon, argon, etc.) and oxygen and nitrogen. But all the common metals, the alkalies and alkaline earths are in the list.

For some of the elements missing from the tables, the spectral lines do not occur in the interval of wavelength from 2,000 Angstroms to 9,000 Angstroms where Dr. Meggers has worked and where industrial scientists and astrophysicists do most of their investigations. Less than half of the measured 30,000 lines fall in the visual range from violet to red.

The number of measurable lines varies greatly from element to element. Scarcely a dozen lines can be listed for elements of simple electronic structure like sodium and potassium. The "rare earth" elements, such as lanthanum and cerium, have each more than a thousand lines in the tables. Also iron, nickel and manganese are rich in measurable lines, and the now famous radioactive uranium has many thousands of lines, a most confusing spectrum, from which Dr. Meggers has made selections of appropriately distributed wave lengths.

The element copper has played a guiding role, a sort of motherly function, in all of this spectroscopic work at the Bureau of Standards. Copper is used as a reference standard for all the other 69 elements. Its spectrum is reasonably "clean," (that is, free from blends) and not too rich. The lines are nicely spread, from the shortest to the longest wave lengths. Also copper works up easily into the electrodes for the direct-current arc.

In practice, the 69 elements are one at a time introduced as impurities into the otherwise pure copper electrodes. The amount of the impurification is accurately controlled—one atom to a thousand atoms of copper. This one tenth of one per cent is ample to give properly the combined spectrum of the "impurity" and of copper, leading to the compilation of the 30,000 lines for the 70 kinds of atoms. The copper itself was standardized against silver of the purest quality possible.

Cooperating with the spectrographic work at the Bureau of Standards, and extremely important for the success of the enterprise, have been the chemical laboratories at the Bureau and at industrial and educational institutions. Some of the elements have been extremely difficult to get in suitable purity.

Parathion Effects Relieved By New Chemical Treatments

Antidotes for Nerve Gas Poisons

➤ An antidote to Parathion and some other nerve-gas types of insecticides, and maybe to the nerve gases themselves, has been discovered.

It is called Buscopan. In treatment of laboratory animals poisoned by Parathion, it is much more effective than atropine. Atropine has so far been considered the best drug for treating both nerve-gas and Parathion-insecticide poisoning.

Buscopan is a German drug. Chemically, it is 1-N-butyl-scopolammonium bromide. It comes from scopolamine, the "twilight sleep" drug once popular as a childbirth pain-reliever.

The effectiveness of this drug as an antidote to poisoning by the insecticides, Parathion, dimethyl Parathion and Systox, was reported by Dr. William B. Deichmann of Albany Medical College at the meeting of the International College of Surgeons in Chicago.

Buscopan, in Dr. Deichmann's opinion, is "terrifically better" than atropine. It acts at the ganglia, which are collections of nerve cells occurring along the chains of sympathetic and parasympathetic nerves. Atropine acts at the nerve endings rather than at the ganglia of these nerve chains. This different spot at which the new drug takes effect may be what makes it, in Dr. Deichmann's experience, so much better than atropine.

Dr. Deichmann emphasized that so far he has only tried the new drug in experimental animals and only as an antidote for the three insecticides, Parathion, dimethyl Parathion and Systox. While these are related to the nerve gases, they are not the same and their effect is somewhat different. Symptoms of Parathion poisoning develop more slowly and are not as responsive to atropine as those of the nerve gases.

Dr. Deichmann also finds that both atropine and Buscopan are more effective when given with oxygen and glucose than when given alone.

Emulsifier Reduces Risk

➤ The nerve-gas type insecticides such as Parathion, and probably the nerve gases too, can have their dangerous skin-penetrating power reduced by more than 100 times through a new kind of emulsifier.

Results of tests showing this are announced by Drs. William B. Deichmann, Patricia Brown and Charles Downing of Albany Medical College, Albany, N. Y.

The emulsifier tested by the scientists is known only as Emulsifier 42-1 A. Chemically, it is an aromatic polyglycol ether obtained when ethylene oxide is added to a phenol of high molecular weight. It is unusual because most emulsifiers increase the toxicity of a chemical by making the compound more soluble. Emulsifier 42-1 A does just the opposite.

The insecticide, however, does not lose its poisonous property for insects as a result of the emulsifier's action.

An emulsifier of this type was first made in Germany but the one Dr. Deichmann and associates tested is being made in this country by the Chemagro Corporation of New York. In his tests, Dr. Deichmann used it with a new insecticide, also made by Chemagro, called Systox. This is a systemic organic phosphate insecticide of the so-called nerve gas class.

The emulsifier and insecticide are mixed and shipped in a concentrated form. It is in this form that the insecticide's ability to penetrate skin and thus cause poisoning is reduced 100 times. But when the emulsifier-insecticide mixture is diluted with water, as the farmer will do when he uses it, the original toxicity of the insecticide is restored.

The emulsifier's protective action is on skin penetration. It is much less effective in case the insecticide is swallowed.

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➤ "MAYBE *a nice chemistry set would get him interested in things like the atom bomb — very educational!"*

Studies of Heredity Use Bloodhound's Clue

Blood and Sweat

➤ THE STUDY of hereditary differences in human body chemistry may one day produce results ranging from an explanation of how bloodhounds can distinguish accurately between human scents, to providing clues for the use of genetics in medicine.

What is called biochemical genetics is the field of Prof. L. S. Penrose, London University geneticist, who led discussion at the British Association for the Advancement of Science meeting at Belfast.

The clue to the bloodhound's powers may lie in the discovery of definite abnormal substances in the sweat of people suffering from an hereditary chemical idiosyncracy called phenylketonuria. Prof. Penrose suggests we shall soon find sweats are as different and as characteristic as bloods and salivas. The bloodhound may depend on such individual differences in the chemicals in sweat for its unerring ability to distinguish between the scents of individuals.

The study of inherited biochemical differences, which enable scientists to differentiate individuals by ordinary chemical tests, may make genetics into an exact science.

Human genetical inquiry attempts to reduce all characters as far as possible to chemical differences. This makes accurate scientific investigation possible, especially if the trait measured is found to be closely associated with the familial appearances of a single genic mechanism. The scientist can examine how the anomalous trait affects the constitution of the individual for good or ill. With the harmful traits, knowledge of the causal mechanisms can help in planning their alleviation and cure.

The study of human constitution becomes an exact science and is freed from ambiguities and superstitions which surround the cult of physical types.

Inborn, hereditary chemical errors listed by Prof. Penrose include errors in: protein metabolism, of which albinoism is a common example; lipoid metabolism, including gargoylism in which there is a grotesque accumulation and distribution of fat in the body; carbohydrate metabolism, as found in diabetes mellitus; and a miscellaneous group which includes such examples as gout and red hair!

Some decades ago inborn chemical differences between people were regarded as unimportant curiosities, Prof. Penrose observes. Now they have been shown to be of quite general significance in the causation of natural variations within the human species.

"Sweat Blood" When Gland Produces Dye

➤ SOME PEOPLE really do seem to "sweat blood." The red color in their sweat comes from a pigment produced by their apocrine glands. These skin glands normally exude unnoticeable quantities of milky white fluid. But

sometimes they secrete a pigment, or dye, into the normally colorless fluid. When the perspiration dries, the pigment remains and attracts attention.

Discovery that the apocrine glands produce this pigment was made by Drs. Walter B. Shelley and Harry J. Hurley, Jr., of the Hospital of the University of Pennsylvania.

Treatment of the condition consists in eliminating the apocrine gland function which is difficult, the researchers state. Ordinary anti-perspirants do not help much. Local introduction of medications into the skin by electrical means have given some encouraging results.

Sweating red, or any other color, is known as chromidrosis. Some cases obviously are caused by chemicals or drugs taken into the body.

For hundreds of years it has been known that workers in copper mines may have green sweat, and that patients may show red sweat after taking certain medicines. In these instances, however, sweating over the entire body is colored, and the external origin of the color has long been apparent.

The type of chromidrosis that remained unexplained until now is limited to small patches on the body. It usually occurs in the armpits, but may occur anywhere on the skin. It is seen only in adults, often in response to emotions. The sweat may be green, blue, black, yellow, brown or blood-red. In the latter case the condition has sometimes been regarded literally by laymen as "sweating blood."

Freezers Are For Food, Not Clothes

➤ THE IDEA that nylon hose last longer if frozen before wearing is debunked in a report from the U. S. Department of Agriculture.

Freezers are for food, not nylons and not winter clothes, Agriculture's home economists state.

Their reasons: 1. Tests by nylon manufacturers showed that freezing does not make this fiber more durable.

2. It is poor economy to take up freezer space with clothes during the season for fruits and vegetables.

3. Fur experts advise against storing fur garments in home freezers. Fur that is stored folded or rolled for any length of time will come out creased or crushed, and then will need glazing or other treatment to lift and straighten fur fibers. If the pelt freezes stiff, it is likely to crack at folds, especially if any weight, like packaged frozen food, is placed on or against it. Finally, there is the risk of damage from dampness, either in the freezer or later when the fur is thawing out. Dampness may cause aging, fading, loss of lustre or even mildewing. Fur garments in commercial cold storage hang loosely so that air can circulate around them. Both temperature and humidity are carefully regulated to keep fur in best condition. Any fur worth home freezer space would seem to deserve expert commercial storage.

4. Clothes can be protected from moths without freezing or even refrigerating them, and the freezing treatment gives no protection when the clothes come out of the freezer.

Molasses is the Starting Material in Making Chemicals and Antibiotics

Yeasts and Sugar

Reprinted from "The Sugar Molecule," Sugar Research Foundation, Inc., New York, N. Y.

➤ ALTHOUGH YEASTS have been performing useful chores for mankind since ancient tribes discovered the delights of wine and fermented milk drinks, it was not until 100 years ago that the truth about their nature and functions became known.

Yests have been around a long time. Fossils remains indicate that during the Devonian era—300,000,000 years ago—they abounded in the air even as they do today. Spores have been found in Theban tombs in the sediment of wine made in 2,000 B.C. Hippocrates, the father of medicine, recommended the dregs of stale beer as a remedy for the plague and leucorrhea. The Bible and ancient literature allude to yeast as a substance akin to life.

Men of science in the 17th and 18th centuries studied yeasts, but missed important central facts. They were on the wrong track largely because any bubbling was thought to be fermentation. Leeuwenhoek, who discovered red blood corpuscles with his crude microscope, examined yeasts but did not realize that they were tiny living plants without chlorophyll. It remained for the great Pasteur to crack the secret.

Microbiologists disagree about what yeasts are, and what they are not. They may, however, conveniently be labelled as true fungi, consisting of one cell, which reproduce by budding, fission, or a combination of these processes. Because of their simple structure they have been a valuable tool in the study of genetics. Of the hundreds of different species and subspecies, most of the yeasts of industrial importance fall into the classification of the *Saccharomyces*, the sugar fermenters.

The most important commercial market for yeasts is bread baking. For other industrial purposes the purity of the strain is not important, but yeasts for baking must be highly uniform. *Saccharomyces cerevisiae*—literally "the sugar-fungus of beer" has been developed to a high degree of uniformity and strength for use by the baking industry.

Baking yeasts are intimately related to sugar in two ways. A mixture of cane and beet molasses is the nutrient most commonly used for the growing of yeasts. And sugar comes into the picture again because the action of yeast in bread dough is dependent on sugar, which it changes to carbon dioxide gas to leaven the loaf. Actually, the enzymes elaborated by the yeast bring about the conversion.

Fifty years ago the production of baking yeast was tied to the brewing industry, but since the introduction of improved processes in 1915, grains have been replaced by molasses as the basic raw material in the mash. A combination of cane and beet molasses provides just the right type of diet for the yeasts.

Molasses varies widely in its constituents, depending on the soil and climate of the area in which it is produced, and the processes used in obtaining it as a by-product in the manufacture of sugar. Yeasts seem to make best growth when nitrogen and phosphorus in balanced amounts are present in the molasses mixture. Molasses is often fortified with ammonia compounds and phosphates.

Through generations of experience gained in the manufacture of yeast, enormous quantities can be turned out today without the failure of a single batch. It remains something of a trick, however, to get uniformity in dealing with living things.

Molasses has to be sterilized, clarified, and diluted as the first step. Without sterilization, rival microorganisms in the molasses might multiply at the expense of yeast. Filtration removes heat-resistant organisms and sludge, which is valueless for yeast growth and may even be inhibitory.

To make sure the parent colony is thoroughbred, yeasts are started in laboratory flasks and transferred to larger vessels in successive growth stages. They finally come in contact with the filtered molasses in huge fermenters which hold as much as 60,000 gallons. Here, under close temperature control, growth gets under way. Air is blown through the mass to stimulate reproduction, and *zulauf*—the German term used to describe trickling more molasses into the propagating tanks—provides a constant supply of nutrients to keep the mass growing. At 86 degrees Fahrenheit, the process moves so rapidly that the heat of metabolism must be removed by cooling devices. When maximum growth has been reached, the yeast "cream" is separated from the spent "wort" in centrifuges. The cream passes to filter presses, where water is extracted to produce solid cakes. These may be broken up, mixed and reformed into compressed shapes, or broken up, dried, and packaged as active dry powdered yeast.

To check on yeast quality, batches of yeast are from time to time put through actual baking tests to see that it is uniform in strength for raising the dough. Variations might make a difference in the quality of the finished baked product.

Increased interest in fermentation processes and the development from molds of the potent drugs—penicillin, aureomycin, streptomycin and terramycin—has stimulated research in yeasts. Eating cakes of fresh yeast enjoyed a vogue some years ago as a remedy for acne and gastric distress. It was quite an effective remedy in some cases, but it is not used extensively today. Yeasts may, however, have a future in pharmacy. Inactive dry yeasts are being used in a number of pharmaceutical products and in animal feeds as good sources of protein and natural vitamin factors.

As research finds new uses for yeasts, molds, and fungi, in the creation of cheaper industrial products and new synthetic chemical and antibiotic drugs, there promises to be an increased demand for sugar and sugar products which are basic starting materials.

Oil can burn only when the flames are fed by vapors rising from the product and mingling with the oxygen in the air.

Atmospheres of Planets Uranus, Neptune Contain Hydrogen, Helium

Atomic Fuel in Distant Planets

➤ THE DISTANT PLANETS Uranus and Neptune contain in their atmospheres hydrogen, one of the atomic fuels that keep the stars burning.

Discovery of the presence of this lightest of all elements in their atmospheres has been made by Dr. G. Herzberg of the division of physics of the Canadian National Research Council, Ottawa.

There is little hydrogen in the earth's atmosphere and none at all has been found in the atmospheres of other planets. Now there appears to be enough in the atmospheres of Uranus and Neptune to show up in spectra of sunlight reflected from these two planets.

There are even larger amounts of helium than of hydrogen, at least three times as much, in the atmospheres of both, Dr. Herzberg calculates. There is so little helium in the earth's atmosphere that it was first discovered in the sun, then later found in our own air. A much larger percentage must exist in the gases surrounding these outer planets.

Both of these planets are so far from the sun that their atmospheres, even when heated by the sun, never get much above absolute zero. Uranus is almost 1,800,000,000 miles from the sun; Neptune is approximately 2,800,000,000 miles from it. Only Pluto is known to be more distant.

Neptune and Uranus, planets remarkably alike in size, mass, density and all other characteristics, are the first known to contain either helium or hydrogen in their atmospheres. The atmospheres of both are composed largely of methane or marsh gas. In addition, Uranus' atmosphere is known to include ammonia, ozone and sulfur dioxide.

Over three-fourths of our own atmosphere is nitrogen, over one-fifth is oxygen. The other elements are relatively rare. If there ever was much pure hydrogen, it has largely escaped into the tip top of our atmosphere or has left the earth entirely. Hydrogen has been retained mostly in combination with other elements, as with oxygen to form water.

Mars is the only other planet in our solar system believed to have an atmosphere capable of sustaining any form of life that we know. The atmosphere of Venus is rich in carbon dioxide, but lacks oxygen and water. The giant planet Jupiter and ringed Saturn contain much more methane in their atmospheres than anything else.

Some fans are running more quietly because of a new nylon fan gear.

The flash point is the temperature at which a product gives off enough vapors to burn.

Chemical Inventions

Patents may be ordered by number from the Commissioner of Patents, Washington 25, D. C., at 25 cents a copy. Remittances should be sent in coin, money order, or U. S. Patent Office coupons, not stamps.

Germanium Alloys

➤ IMPROVED alloys of germanium, particularly for use in rectifiers of electricity, have been invented by Dr. Karl Lark-Horovitz and Randall M. Whaley, La Fayette, Ind., and assigned to the Purdue Research Foundation. Dr. Lark-Horovitz is head of the physics department at Purdue.

These alloys are all of the so-called N-type semi-conductors. They are made of germanium combined with such materials as copper, silver, magnesium, calcium, zinc, strontium, cadmium, barium, titanium, tin, lead, nitrogen, vanadium, columbium, tantalum, bismuth, chromium, uranium, cobalt, nickel or palladium. Patent number is 2,600,997.

Surface on Bread Pan

➤ BREAD PANS do not need to be greased, the newly baked bread will come out without tapping on the bottom, with an invention patented by William R. Collings, Midland, Mich., who has assigned his patent, number 2,606,510, to the Dow Corning Corporation, Midland.

The inventor says that baking bread by a continuous mechanical process—not touched by human hands—must now be interrupted at the point when the bread is finished baking. Some of the loaves stick to the bottom of the pans, some more than others. Further, greasing the pans is an expensive, time-consuming and messy job.

He coats an ordinary bread pan, new or used, with an organosiloxane resin. After coating, the pan is heated to cure the resin at a temperature of at least 350 degrees Fahrenheit for 15 minutes or longer. Then no grease is needed and the loaf slips out of the pan with ease.

Salt Through a Pipe-line

➤ TABLE SALT, potash and some metals may be moved through pipe-lines by methods invented by Walter M. Cross, Jr., Kansas City, Mo., and assigned to the Kansas City Testing Laboratory. He received patents number 2,610,899, 2,610,900 and 2,610,901.

Mr. Cross incorporates the solid materials to be transported into suitable liquid transporting media so they will go through the pipe-line. The success of his method, he says, depends on the fluids used. One viscous fluid medium is a gel or suspension of colloidal clays, especially aqueous colloidal suspensions. One form can transport both suspended solids and dissolved salts. A saturated water solution of potash can also be used. Or oil for moving potassium chloride crystals may be used.

Mr. Cross claims that this method can achieve savings in transportation costs of up to 80%.

Triple Attack on Germs

➤ "BIO-STRATEGIC" warfare against harmful bacteria can be conducted by a new three-way antibiotic preparation patented by Hermann Vollmer, New York. He assigned his patent, number 2,602,038, to Sharp and Dohme, Inc., West Point, Pa. His preparation consists of a combination of three "wonder drugs," sulfadiazine, penicillin, and sulfamerazine.

Mr. Vollmer explains that the three drugs enter the blood stream in succession and reach their highest blood concentration at different times. The sulfadiazine, getting there first, kills off the weaker strains of bacteria, but the stronger strains adapt themselves to sulfadiazine. However, the bacteria are at the same time weakened against the following, unexpected attack from penicillin.

The bacteria, Mr. Vollmer says, are like military forces which have been trained for tropical warfare but are sent to the Arctic. They would be less able to resist the cold of the north than troops without training for the tropics.

The few remaining bacteria that survived the penicillin attack, according to the inventor, are knocked out by the third attack with sulfamerazine. Mr. Vollmer claims this is distinctly different from the conventional method of administering two drugs at a time. The conventional way aims at a simultaneous knockout, while the new method is a one-two-three affair.

Chlorophyll and Radio Carbon

➤ CHLOROPHYLL, the ubiquitous green agent of plants, plays an important part in a new method of separating the light and heavy radioactive isotopes of carbon used in medicine and research. The method was invented by Melvin Calvin and John W. Weigl, Berkeley, Calif., and assigned to the Atomic Energy Commission. Its patent number is 2,602,047.

The invention is based on the fact that organisms that contain chlorophyll use carbon dioxide to form complex organic molecules when they are exposed to the sun. The problem is to separate the heavier radioactive carbon isotopes, 13 and 14, from the lighter isotope, carbon 12.

The carbon dioxide containing a mixture of the isotopes is fed to algae, one-celled plants. The sun is allowed to shine upon them and photosynthesis takes place. The carbon dioxide containing the lighter isotopes is preferentially absorbed by the algae during the photosynthesis process. In this manner, according to the inventors, it is possible to separate the heavier from the lighter radioactive isotopes.

Atom Model

➤ A MOVING model of an atom has been invented by John B. Underwood, Grass Valley, Calif. Its patent number is 2,601,729. In the invention, balls representing electrons move around a central nucleus. The inventor wants to demonstrate the movement of the particles composing the atom.

Water-Repellent Glass Cloth

➤ A GLASS CLOTH, for use in clothing, tents or awnings, which is water-repellent has been invented by Games Slayter, Newark, Ohio, and assigned to the Owens-Corning Fiberglas Corp.

In most water-resistant cloth, the inventor says, the strands of the cloth absorb moisture and swell, thereby

greatly diminishing the permeability of the fabric. This happens even though the strands are coated with a water-repelling material.

A water-repelling substance will preferentially adhere to glass in the presence of water, the inventor claims, and therefore, when used on glass cloth is not displaced by water. Mr. Slayter makes his cloth out of both large and small size glass fibers. The small fibers tend to fill up the holes between the large fibers. Because the glass does not swell, the cloth can still "breathe," allowing the wearer to remain comfortable. Patent number 2,604,688 was assigned to this invention.

Chlorine Leak Detector

➤ A QUICK-ACTING chlorine gas detector has been invented to warn truck drivers and warehouse watchmen of leaks in chlorine bottles and to give them time to repair the leaks before serious accidents occur.

Invented by Carl Sundstrom of Syracuse, N. Y., and assigned to the Allied Chemical & Dye Corporation, the device continuously samples air from around the bottoms of the chlorine containers. When it "smells" chlorine, a test strip changes color, warning the truck driver or the watchman of a leak. The device was granted patent number 2,606,101.

New Hot Rubber Equal To Cold

➤IN SCIENCE'S continual striving to make better synthetic rubber, a way is claimed to produce rubber at ordinary temperatures with qualities that equal superior "cold" rubber.

Through use of a chemical catalyst that is known as Nitrazole CF, pilot plant operation has been completed and a short production run of the new rubber has been made in government-owned plants by the Firestone Tire and Rubber Co.

Firestone officials are enthusiastic about the results while others are not so convinced that the new development will produce such uniform results that the program of refrigerating the plants to the 41-degree-Fahrenheit temperature needed for cold rubber will be made unnecessary.

The new Nitrazole rubber can be made in the World War II plants for GR-S rubber production at 122-degree temperatures to bring about the polymerization.

When production and development problems are worked out on the new rubber, it may be possible to obtain even better rubber for future automobile tire treads by using the cold temperatures with different chemicals than are now used in cold rubber production.

Still in development, the work on the new synthetic 122-degree rubber will be continued. Regular production in the government-owned plants will be the cold rubber of the present production and even some of the hot rubber such as used in war days.

The catalyst Nitrazole CF is a dye intermediate which is chemically paranitrobenzene diazonium parachlorobenzene sulfonate. The cold rubber Redox catalyst system uses iron salts and organic peroxides, while the older hot rubber uses potassium persulfate.

Proudly Presented

➤ "What's a Silicone?" is answered in a booklet issued by Dow Corning Corporation, Midland, Mich. Part of the answer is that silicones are fluids and resins that keep clothes and shoes and brick walls dry in the rain. They are compounds that keep radar from going blind on a foggy night. They are fluids that polish without rubbing. They are rubber that will not melt on hot aircraft engine cylinders or freeze on switches that operate bomb bay doors at 100 degrees below zero. They are electrical insulating resins and varnishes that double the power of electric motors or multiply by ten the life of electrical machines.

➤ The Textile Industry is selected for a salute by Cenco News Chats, publication of the Central Scientific Co., 1700 Irving Park Road, Chicago 13, Ill.

➤ Duran plastic furniture covering, just adopted by the Ringling Bros. circus for folding chairs under their "big top," is described in the Rohm and Haas Reporter, Philadelphia 5, Pa.

➤ Laboratory manual on "The Care and Handling of Glass Volumetric Apparatus," giving practical information on its use, is offered without cost by the Kimble Glass Division of Owens-Illinois Glass Co., Box 1035, Toledo 1, Ohio.

➤ Rocks, minerals and geological supplies are listed in a catalog of the Eckert Mineral Research Naturegraph Company, Florence, Colorado.

➤ A paint-anchoring corrosion-resistant phosphate treatment for metals is described in a pamphlet from Octagon Process, Staten Island 1, N. Y. Common causes of paint failure and how they can be prevented are described and application of the pre-painting treatments by phosphating compounds is described.

➤ Short descriptions of more than 50 Bakelite and Vinylite plastics, their properties and uses, are condensed into an 8-page ready reference file compiled and recently published by Bakelite Company, a division of Union Carbide and Carbon Corporation, New York 17, New York. Visually aided by 56 photographic illustrations picturing actual finished products, this new booklet covers in abridged form the wide range of special and general-purpose plastics.

➤ Aluminum alloy is used in making clamps for chemical apparatus offered by one distributor, Phipps & Bird, Richmond 5, Va. Some have clamps that grip by pressure, others have the conventional set screws, one has three prongs, and there is a set-up frame also of the light metal alloy.

➤ Laboratory aprons are made in two weights out of plastic material, one transparent and the other opaque black, by Chemical Rubber Co., Cleveland 14, O. Electronically bonded triangular reinforcements prevent the ties of these aprons from tearing through the tie holes.

➤ Add a thickening agent such as a metallic soap to vinyl resin plastisols and putty-like substances are formed. These are suitable for hand modeling. The plastigels are described in a pamphlet obtainable from the Mellon Institute, Pittsburgh.

Book Condensations

New books in chemistry listed for readers' information. These or any other American books in print may be ordered through Science Service, Book Department, 1719 N St. N.W., Washington 6, D. C.

Send check or money order to cover regular retail price. If price is unknown, send $5.00 and change will be returned. We will pay postage in the United States. For each free publication desired, send 10c to cover handling.

THE CHEMISTRY AND CHEMICAL UTILIZATION OF BEECH — George J. Ritter — *Northeastern Forest Experiment Station*, 17 p., paper, free upon request of publisher, Upper Darby, Pa. In chemical make-up this wood is similar to birch and maple. Its ash makes a fertilizer especially useful for growing large potatoes.

THE CRYSTAL STRUCTURE OF SOLID CHLORINE—Robert L. Collin—*Mellon Institute*, 2 p., paper, free upon request to publisher, 4400 Fifth Ave., Pittsburgh 13, Pa.

DETONATION IN CONDENSED EXPLOSIVES—J. Taylor—*Oxford University Press*, 196 p., illus., $5.00. A description of the detonation in those explosives especially used in industry.

INTRODUCTION TO CONCEPTS AND THEORIES IN PHYSICAL SCIENCE—Gerald Holton—*Addison-Wesley*, 650 p., illus., $6.50. An introductory text designed for students who do not intend to major in chemistry or physics. Presents basic ideas and theories rather than a survey of the field.

THE MINERAL RESOURCES OF THE WORLD — William Van Royen and Oliver Bowles — *Prentice-Hall*, Atlas of the World Resources, Vol. II, 181 p., illus., $10.75. Maps showing the distribution of 29 minerals, all of which are important in world trade. Largest uranium deposits are in Canada and the Belgian Congo.

PRINCIPLES AND METHODS OF CHEMICAL ANALYSIS—Harold F. Walton—*Prentice-Hall*, 435 p., illus., $8.65. Text intended for senior undergraduates and graduate students covering the field of non-instrumental analysis.

QUANTITATIVE CHEMICAL ANALYSIS —Leicester F. Hamilton and Stephen G. Simpson—*Macmillan*, 10th ed., 529 p., illus., $4.50. This text has been extensively revised since its original publication under the title, Talbot's Quantitative Chemical Analysis. More space is devoted to theoretical discussions and laboratory directions are given to aid the student.

SEMIMICRO LABORATORY EXERCISES IN GENERAL CHEMISTRY — J. Austin Burrows, Paul Arthur and Otto M. Smith—*Macmillan*, 2nd ed., 302 p., illus., paper, $3.50. At present over 700 students at Oklahoma A. and M. are performing these experiments with inexpensive semimicro equipment and this manual.

THE TECHNOLOGY OF COATED AND PROCESSED PAPERS—Robert H. Mosher, Ed.—*Chemical Publishing Co.*, 733 p., illus., $15.00. This volume succeeds one on Specialty Papers, and deals with operation and equipment for the converting of paper. For the engineer and chemist.

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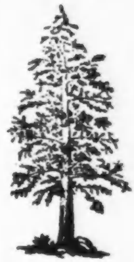

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